

Lewis Baker

A MANUAL  
OF COST CUTS  
FOR STRONG  
ACCEPTABLE  
HOUSING

COSTFORD

## THE AUTHOR

Baker's life is a legend. He belongs to a rare species of scholars who found the roots of wisdom in concrete men. Laurence Wilfred Baker was born in England in 1917. He had his education from King Edwards Grammar School, Aston. After studying at the Birmingham School of Architecture, he became an Associate of the Royal Institute of British Architects. He started his career as an architect to Friends Ambulances Unit, E. England during the world war and worked in China and Burma.

As an architect in a tropical climate, he came to India in 1945 where he was exposed to an entirely new environment. He was fascinated to see the skills of ordinary, poor village people working with the most unimproving and crude materials with almost no recognizable leads to make useful everyday buildings and articles.

In 1948 Baker married Elizabeth Jacob, a like minded doctor from Kerala and entered down in remote areas of the Himalayas to run their own schools and hospitals - centers of medical and architectural work where for more than one and a half decades.

The land and its people enlightened his ideas and the compulsion of information from ordinary people enriched his vision. He discovered a hidden heritage in the local indigenous style of architecture, the result of thousands and thousands of years of research and collective experience of many generations on how to use only immediately available, local materials to make structurally stable buildings that could cope with the local climatic conditions, with the local geography and topography, with all the hazards of nature, with possible hostile neighbours, houses that could accommodate all the requirements of local religious, social and cultural patterns of living. He learnt about more and more local materials and devised new patterns using burnt bricks, stone, mud, that, and timber and applied new kinds of mortar and plaster in his works.

Baker abhorred all forms of extravagance and waste. Two important characteristics marked in Baker's architecture the small is not only beautiful but is often essential and even more important than large; and if architects are ever to start interacting effectively with the real building problems and the hapless needs of the world, they must learn how to build as inexpensive as possible. The ideal is that there is a form of direct unity with the creator, that man experiences this at any time, in any place and under any circumstances.

For a number of reasons, the Bakers pulled up their roots from the Himalayas and moved to Kerala and settled in a remote mountain area among the neglected tribes and castes. Baker's interest and work spread and he concentrated more on housing and rural development work. Some industrial buildings in North and Mid India, a lot of Churches and a Cathedral were his important contribution during this period.

By this time the Government moved in to examine what is going on. The then Chief Minister C. Achutha Menon became a convert to his architectural style and Baker built the State Institute of Languages for a small sum of money which the works and housing department had declared was impossible. Following this a fairly large and pretentious complex known as Centre for Development Studies and some other Government Institutions were constructed by him.

The people were quick to understand the principles involved in cost reduction and real provision of building a house. The upper strata came forward with interest when quite a lot of them built their houses using these simple cost reducing techniques. For the lower middle class the style was rewarding as they can construct a house within their reach.

As a popular specialist in cost effective building and conservation of energy by avoiding energy intensive materials - with a stress on upholding the wonderful Indian vernacular ways and styles of building Baker brought people close to their culture. Throughout his working life, the whole business of planning and designing has been intensely absorbing and fun for him. Always living close to nature he learned many lessons from the design of God's creations. He has produced uncountable designs each has a unique identity whether big or small. He breaks all conventionalities of shape. The free flowing lines and graceful curves in his design create a harmonious atmosphere for living. His buildings invite the dweller to be part of it. Planning of space is design is an important factor in cost reducing construction. In a country with 80 million homeless it is improper to use money, natural resources or energy lavishly or unnecessarily.

As an architect of vision and vast experience Baker is an active participant of various Government schemes. He is and has been adviser to planning and governing bodies of institutions such as HUDCO, MID, CBRE, FRI, UPDESD etc. and have been active with and designed for MHA Marketing Board, Liverpool Development Board. He is a honorary fellow of the Centre for Development Studies.

Baker defies all critics with good humour and his sketches are excellent. He has produced do-it-yourself books, illustrated by him titled How to Reduce building costs, Brick work, Mud, Community buildings, Schools, Rural hospitals etc. His writings brims with information. In all he stresses cost control and avoiding energy waste and intensive materials. He has given many reports to Government on Earthquake.





# A MANUAL OF COST CUTS FOR STRONG ACCEPTABLE HOUSING

by Louis G. Baker

First Edition : December 1999

Price : India : Rs. 80/-  
Foreign : \$ 5/-

Any part from this book  
may be freely used for no profit purposes  
after acknowledgement.

Published by : **COSTFORD**

**CENTRE OF SCIENCE AND TECHNOLOGY  
FOR RURAL DEVELOPMENT**

AYYANTHOLE, THRISSUR - 680003  
KERALA, INDIA

Phone : 91- 487 - 360788 / 364203

Fax : 91- 487 - 391679

Email : costford @ vsnl.com

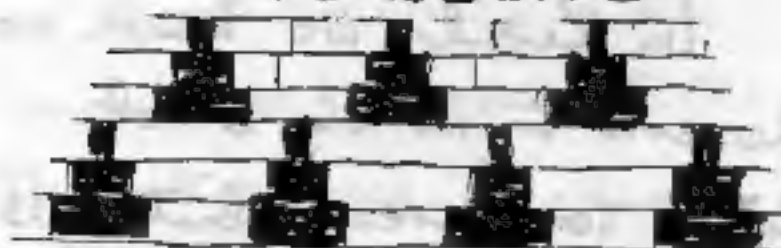
---

Printed at : Viva Printers, Thiruvananthapuram - 680012 Phone : 360197, 360240

---



**MANUAL**  
**OF**  
**COST**  
**CUTS**  
**FOR**  
**STRONG**  
**ACCEPTABLE**  
**HOUSING**



**COSTFORD**

This manual is mainly put together to help deal with working out inexpensive, effective & acceptable housing schemes for the homeless families in Kerala.

Perhaps much of the contents of the manual may be of relevance to many other parts of India.

In Kerala we have no deserts & no big black cotton soil areas, but it is hoped that some sections

of the manual will be of help to anyone planning to build small houses on small plots for homeless families.

Some of the material may also be of help when rebuilding houses which have been destroyed by cyclones, floods, earthquakes, landslides & so on.

Almost everything in the manual has been used & tested by the writer over the past half a century in India.



What kind of city is this?  
How do you think it got there?



What kind of city is this?  
How do you think it got there?



This is the usual unplanned colony, made by the occupants, with mainly waste materials & with no thought of "planning".

This is the currently fashionable 'modern' new colony - long straight roads with identical cement block & roof 'boxes' in straight rows.

The third sketch is that a colony could look like - for much less cost - with houses of equal area, but different plans & designs chosen by the occupant. The houses are in clusters round a common area to be used for community work, play & recreation. Each 'cluster' adjoins a road.



## TRADITION v MODERN

This is not meant to be a battle between traditional & modern forms of architecture,

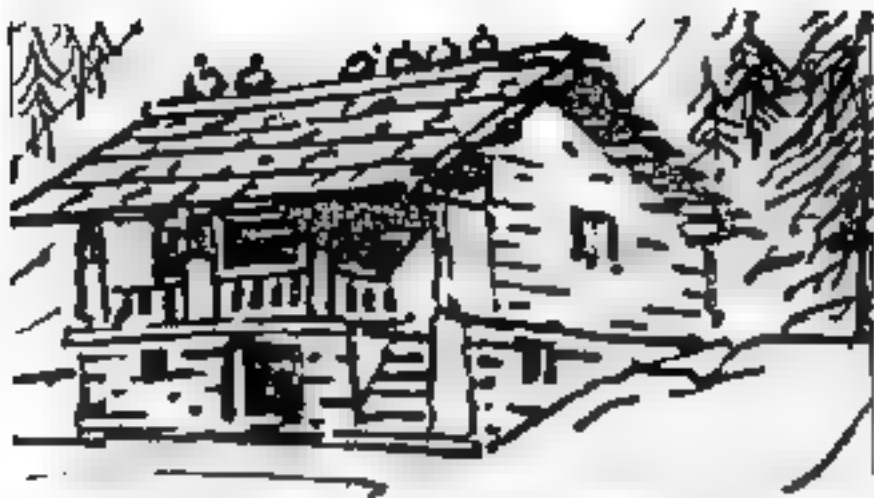
Especially in India there is no such thing as ONE Traditional INDIAN Architecture.

Every district has its own traditions &, by trial & error, over thousands of years, people have learned how to use, and to cope with, all the many factors which are involved in Architecture.

—The Site, The Topography & Geology, The climate & vegetation, The available local materials — The religious & cultural patterns of living, & The main local occupations.

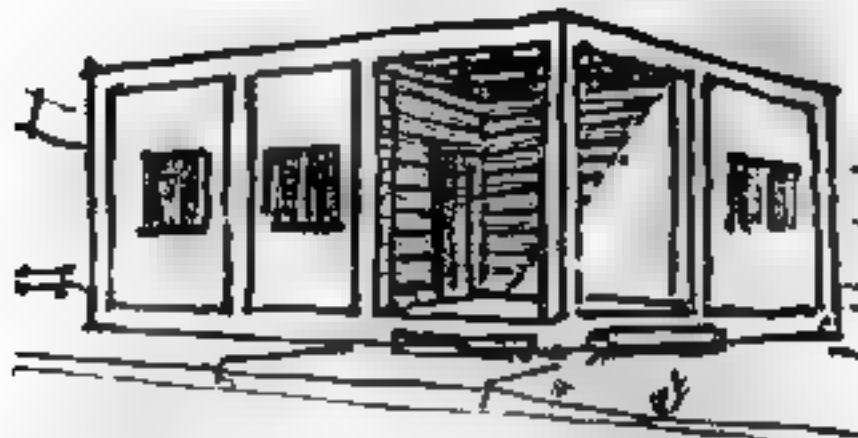
Unsatisfactory items have long since been discarded & alternatives have been tried until a Satisfactory Solution has been found.

It seems foolish, therefore, to abandon the tested findings of centuries of "Science & Technology".



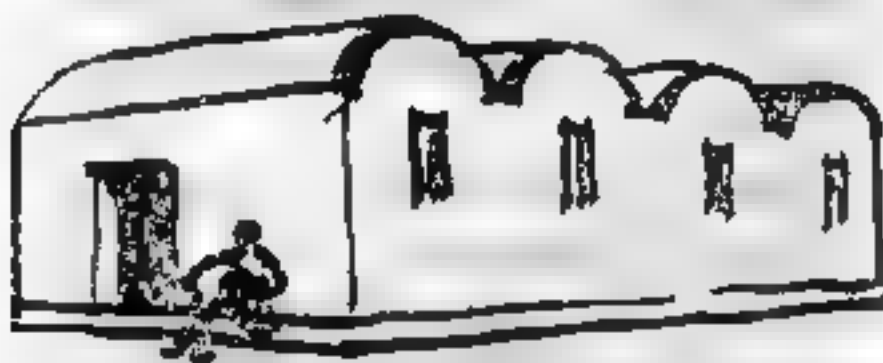
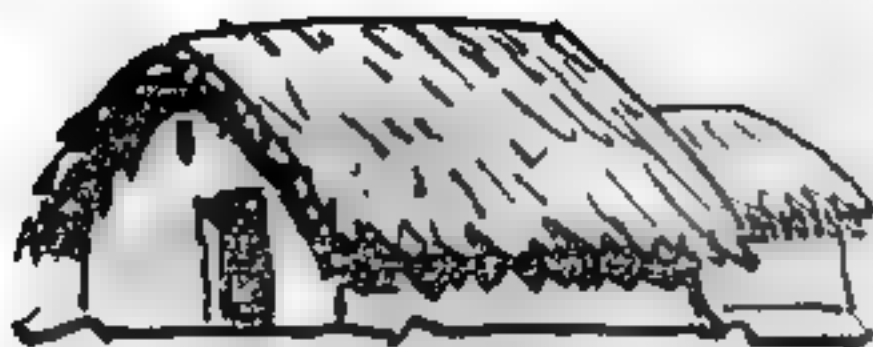
Here are typical regional styles  
of architecture — above from the  
northern Himalayan slopes and  
below from Kerala in the South.





Above is a sketch of one version of the 'Modern', 'Western' style which can now be seen in the North, South, East, West & Middle of India.

It is built of costly energy intensive materials & has no regard for site, topography, climate, culture or religion, occupations or way of local life of the occupants.





Thatch gives a cool interior  
but it needs annual replacement  
(There are ways to prevent this)  
→ But it is easy to make extensions.

A Tile roof can also be easily  
extended — but you need  
more costly timber for it.

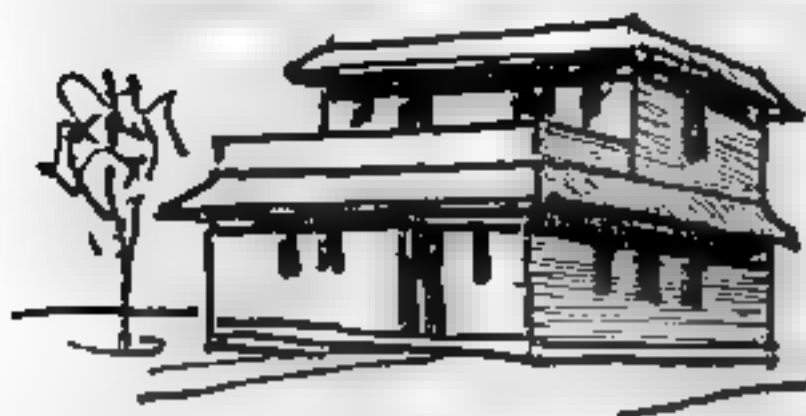
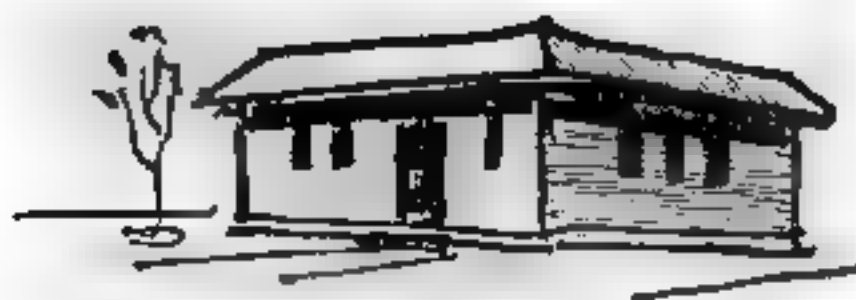
Modern Ferro-Cement shells,  
& other new concrete systems  
of roofing, absorb & retain  
a lot of heat from the sun.  
Joints also soon leak from  
constant expansion & contraction.  
Once a colony is completed,  
it is difficult to make ones  
own extensions & they don't  
usually enhance that  
'Modern Look' !



## A CORE HOUSE

should be designed both in plan & section so that as & when extensions are to be added, roofs, doors, windows etc are in the right places.

The original unit must also be carefully placed on the plot so that there is space for extension on all sides & bye-laws re distance from boundaries are not broken.



# A VERTICAL CORE HOUSE

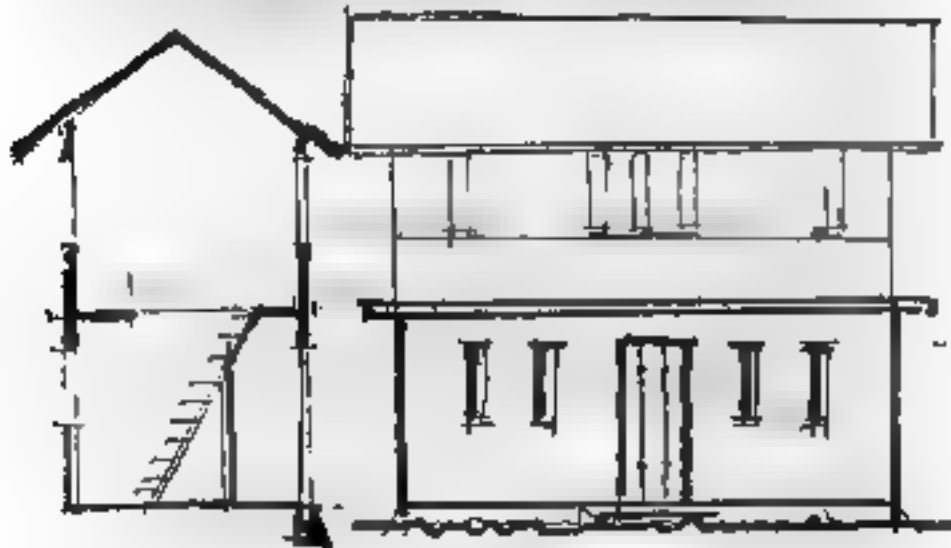
If a small plot will not accommodate lateral expansion of a small house you can plan for future vertical expansion.

You must of course cover your ground floor rooms with a flat roof & it is preferable, also from the beginning, to plan for stairs.

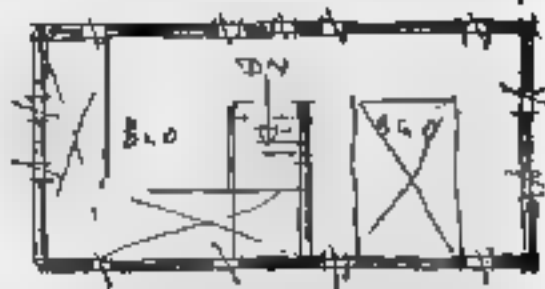
These will make your flat roof usable, & of course will eventually connect the additional floors with the original ground floor.



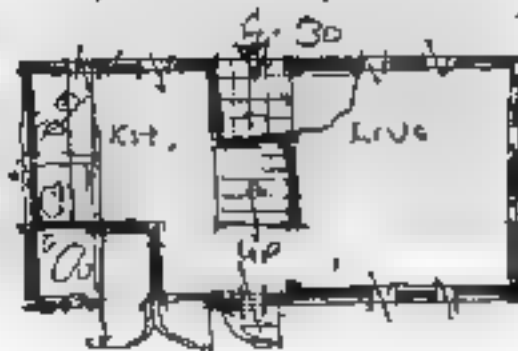
# FUTURE VERTICAL EXPANSION



FUTURE  
FIRST  
FLOOR



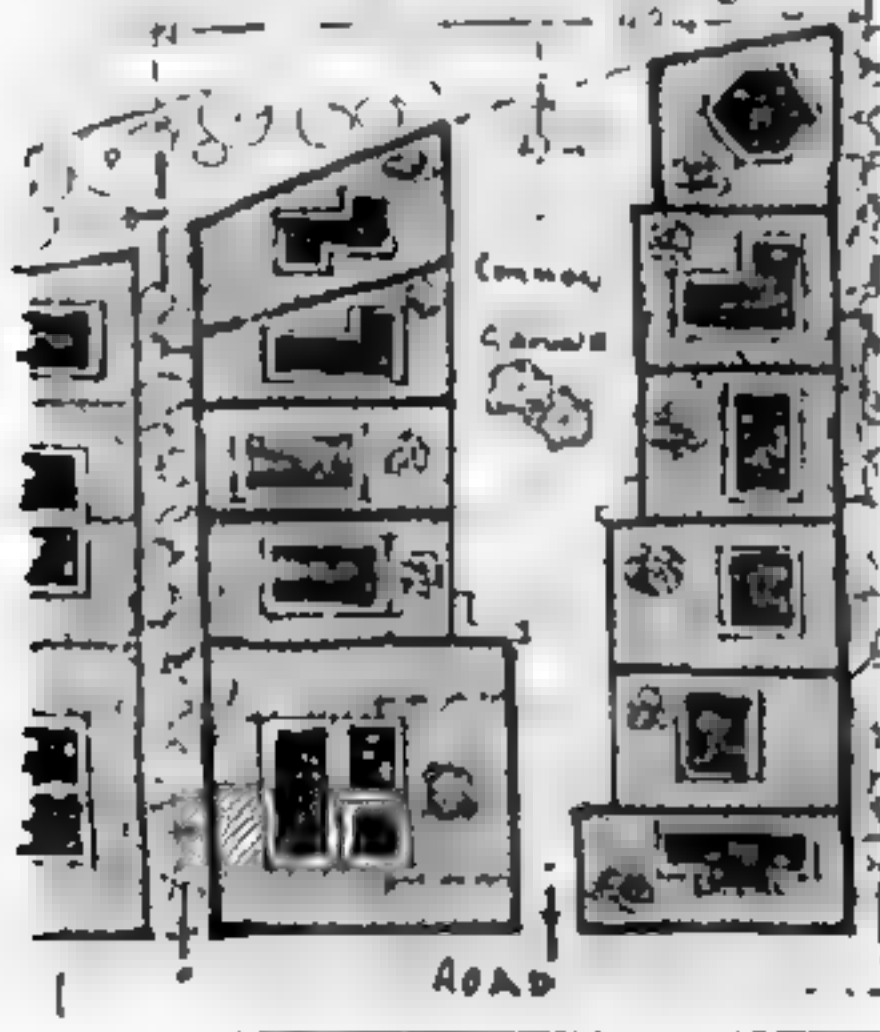
GROUND  
FLOOR.



If your plot and your funds are too small, start off with the ground floor, but plan it to contain a stair to take you up, first, to an open flat roof terrace, & later to another floor of bedrooms on the first floor above the original ground floor cottage. This extension will only cost half as much as the first building

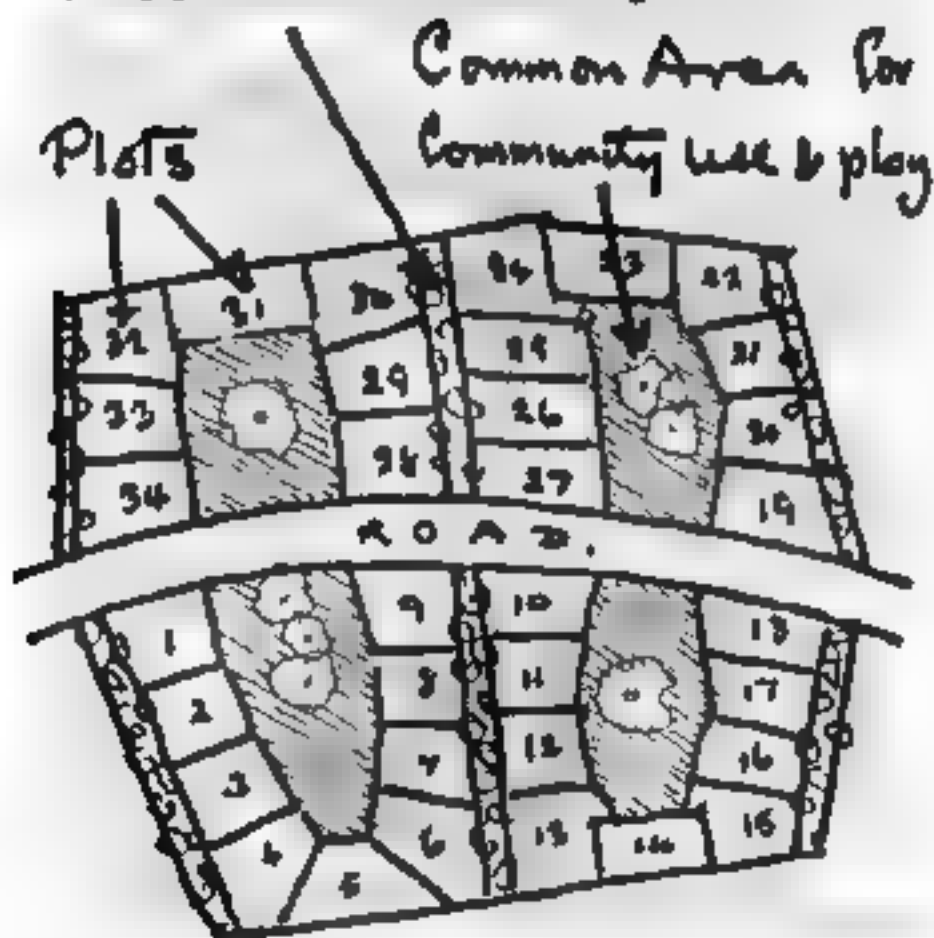


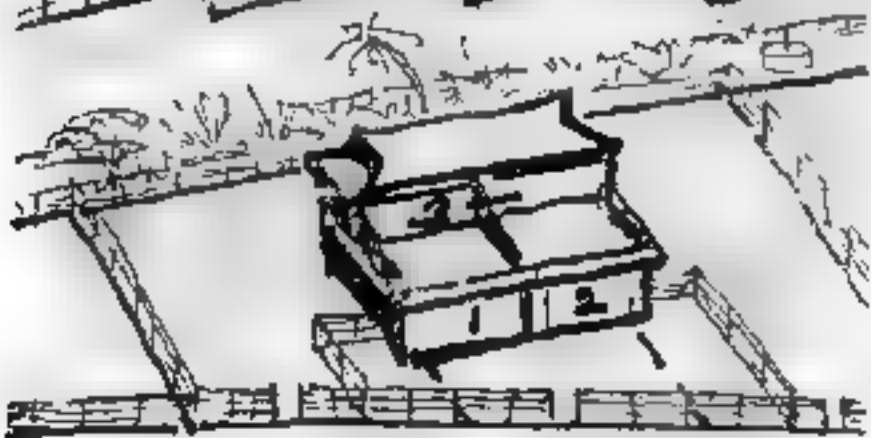
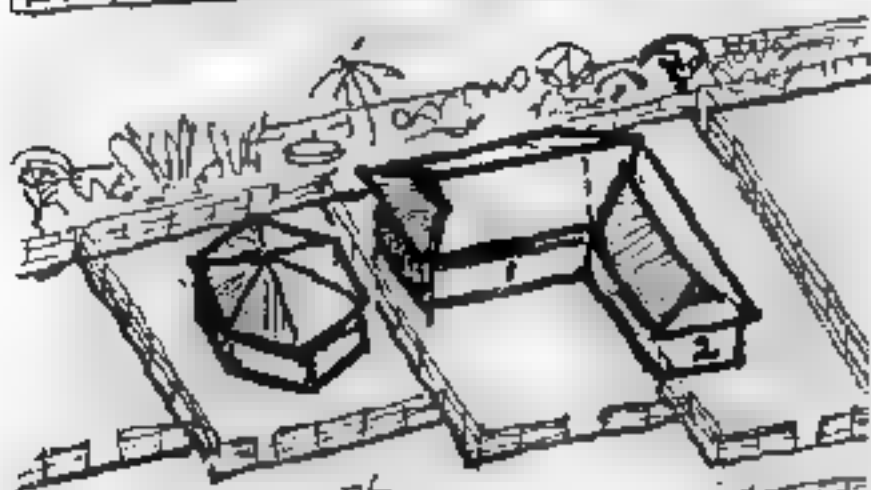
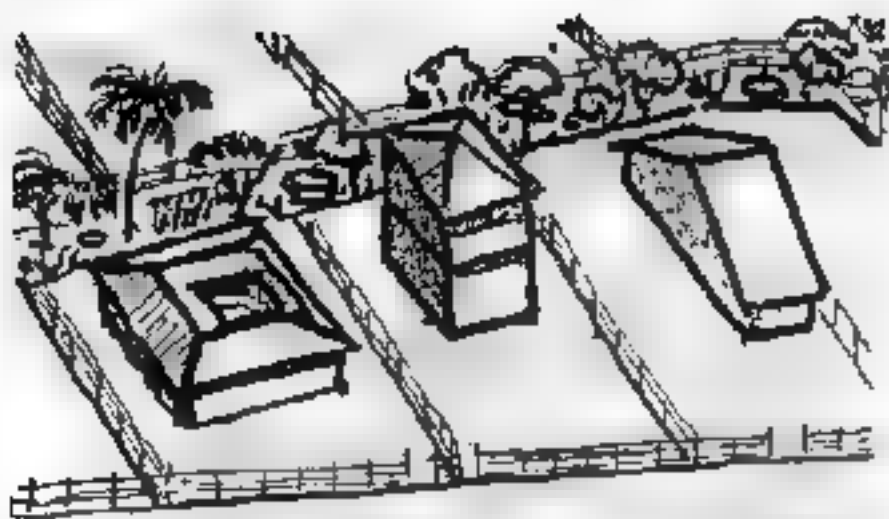
All plots the same area  
All houses the same area



# MINIMUM ROAD THRO COMMUNITY CLUSTERS

Gully for Sanitation, Bio gas,  
Fuel & Fodder trees, etc.

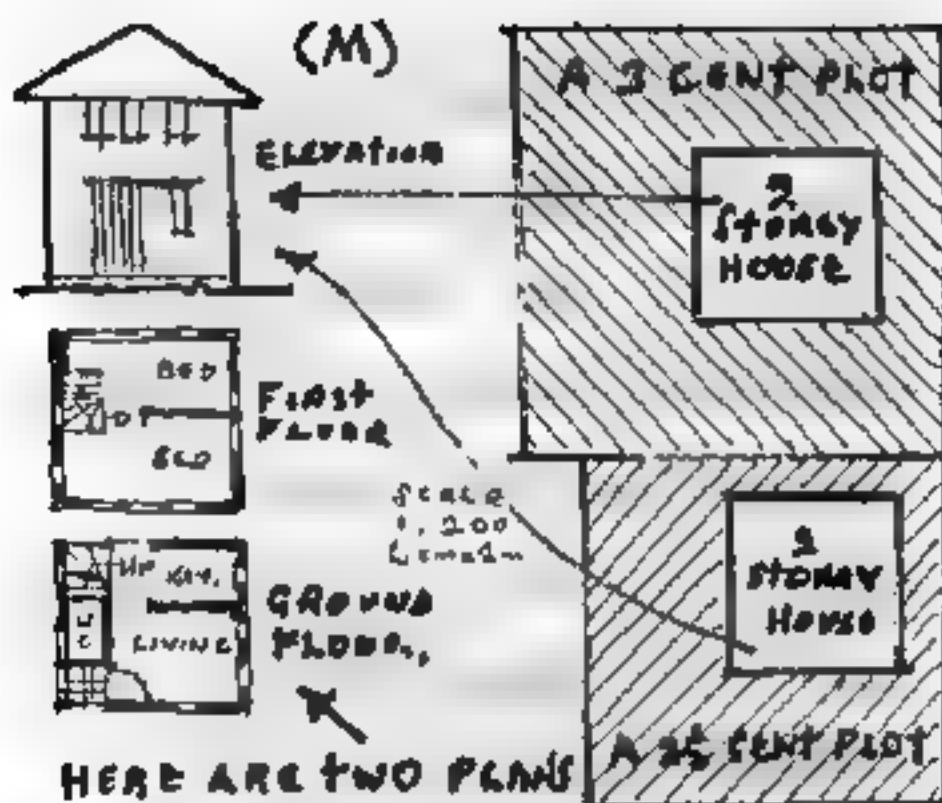




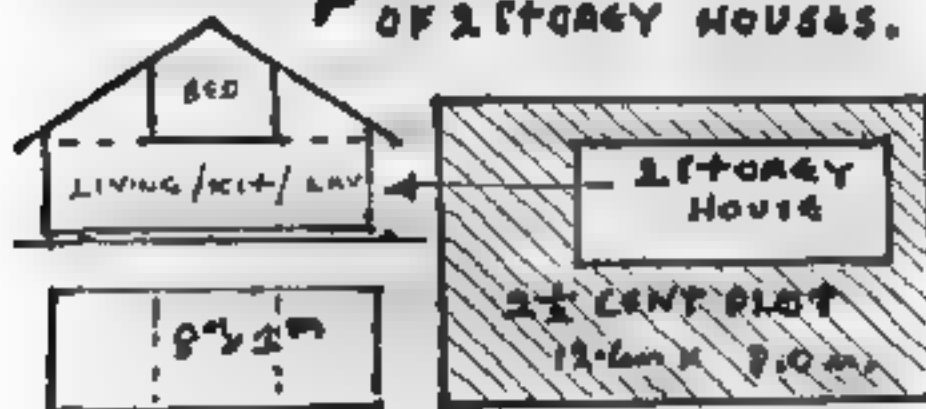


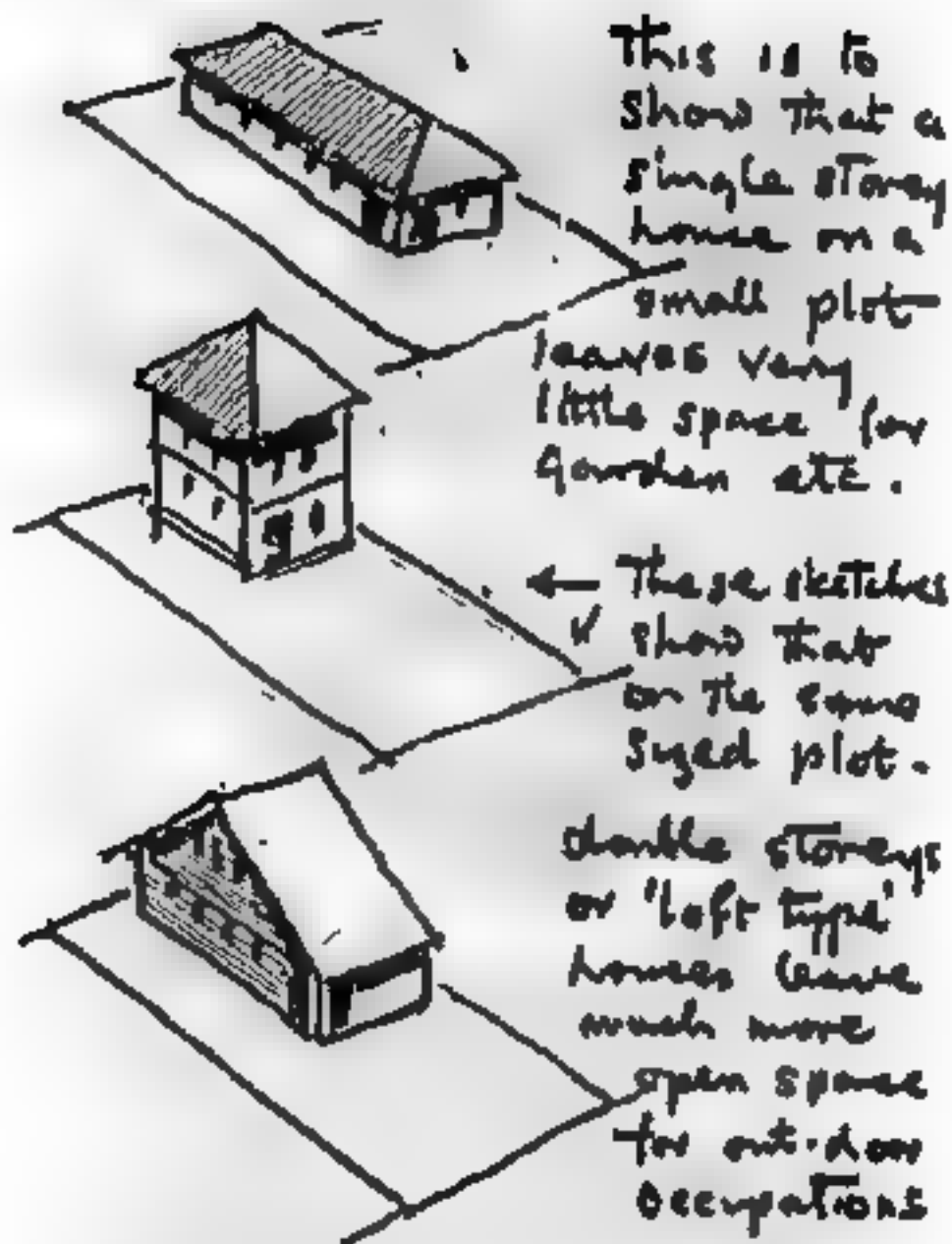
**CLUSTER** planning around a common open space for communal work & play (and for bullock cart parking etc!) cuts down pukka road lengths, allows for a variety of house designs, & encourages neighbourliness.

An open narrow space between clusters can contain fuel & fodder & fruit trees, along with space for sanitation including communal gas plants etc.



HERE ARE TWO PLANS  
OF A WIDE VARIETY  
OF 2 STORY HOUSES.

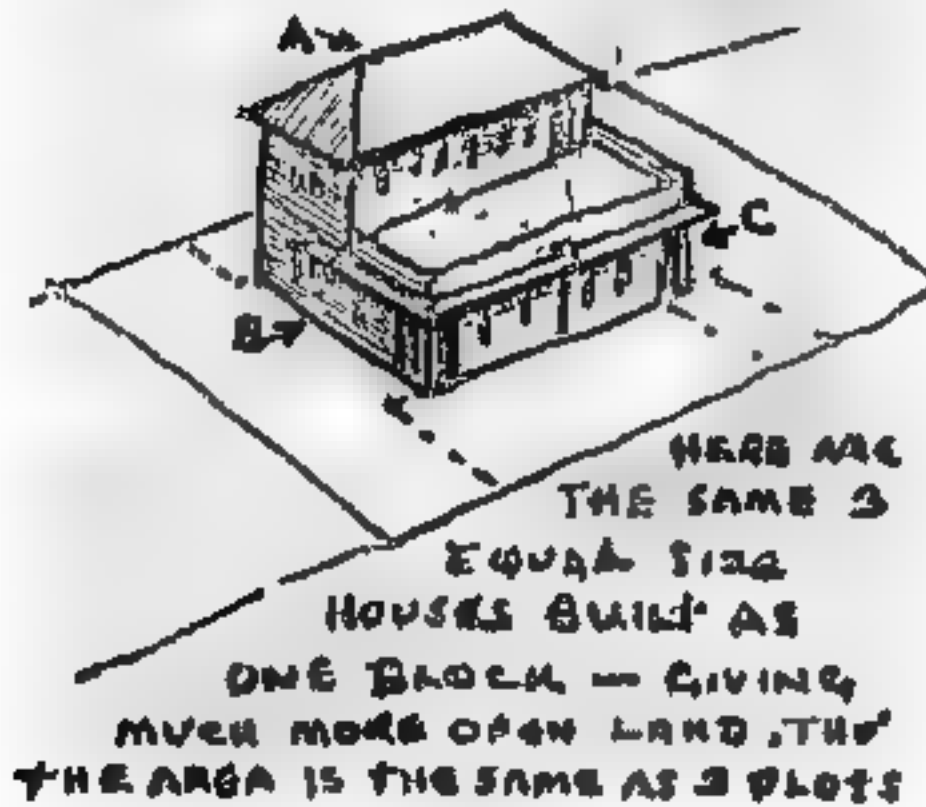
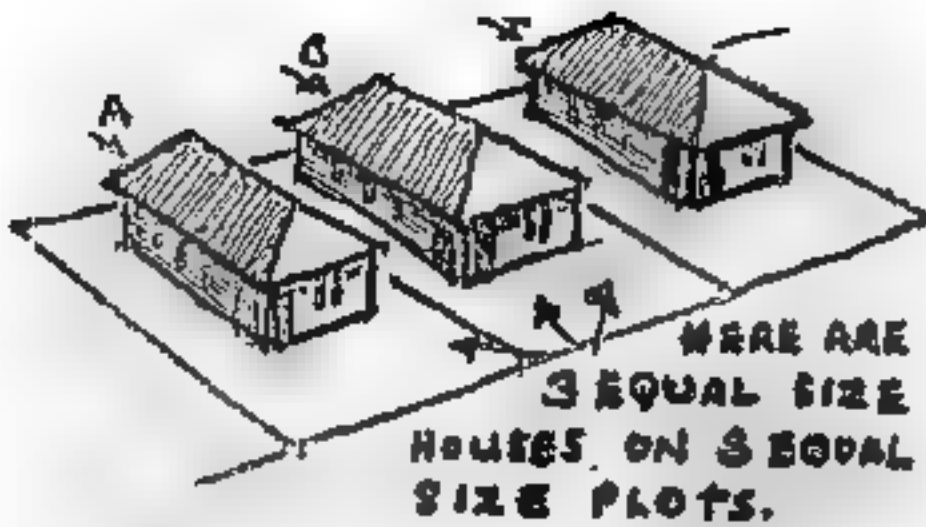




This is to  
show that a  
single storey  
house on a  
small plot  
leaves very  
little space for  
garden etc.

← These sketches  
✓ show that  
on the same  
sized plot.

double storeys  
or 'loft type'  
houses leave  
much more  
open space  
for out-door  
occupations



## SMALL HOUSES

### ON SMALL PLOTS

leave very little open land around each house.

When there are 3 Brothers & their families (or perhaps 3 close friends) the three houses can be built as one block & then there is much more open space for each family.

Further more - The upper house also has a nice big terrace (as large as his house) above the 2 ground floor houses.



# COST EFFICIENCY

With The Country having millions of homeless families, it is imperative that what money is available must be used only for essentials, & none of it for fancy frills !

There are many factors that **MUST** be kept in mind. MATERIALS — Are the materials we want to use for building **LOCALLY AVAILABLE** ?

If not — can we afford Transport costs? Can we not use only locally available items as far as possible ?

Then we must **ALWAYS** keep the CLIENT in mind .

Remember that the CLIENT  
is the beneficiary—not a  
Government Department etc!

Will he be able to  
accommodate comfortably all  
his dependents?

Will he be able to extend the  
house when, later, his sons  
grow up & earn money?

Will the house be strong  
and secure?

Can sheds or verandahs  
be added by him for home  
occupations, like carpentry  
or weaving, etc?

Does the plan allow for  
local cultural & religious  
ways of living?

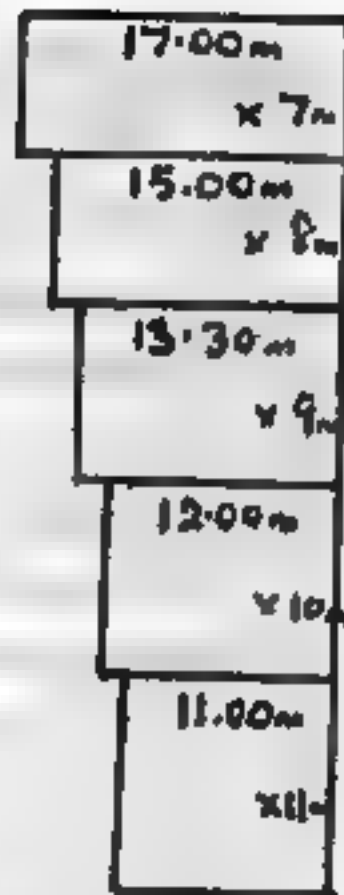
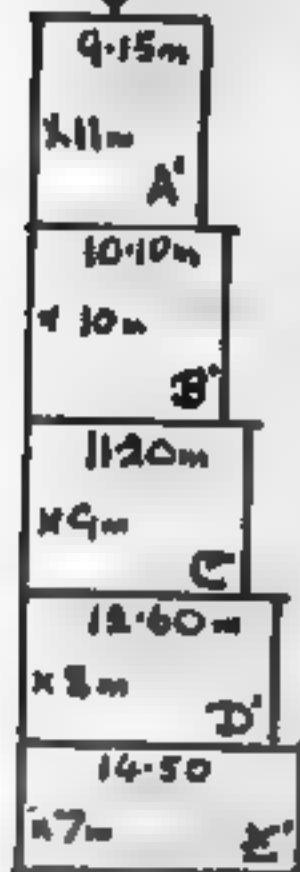
What about water and  
sanitation? And what about  
approachability.

Our aim of 'cost-efficiency'  
must include all these things.

# PLOT SIZES

All these plots  
are the same  
area -

2.5 cents



All these plots  
are the same  
area -  
- 3 cents.

& of course there  
will often be  
irregular shapes.

Plot SHAPES need not always be square or rectangular.

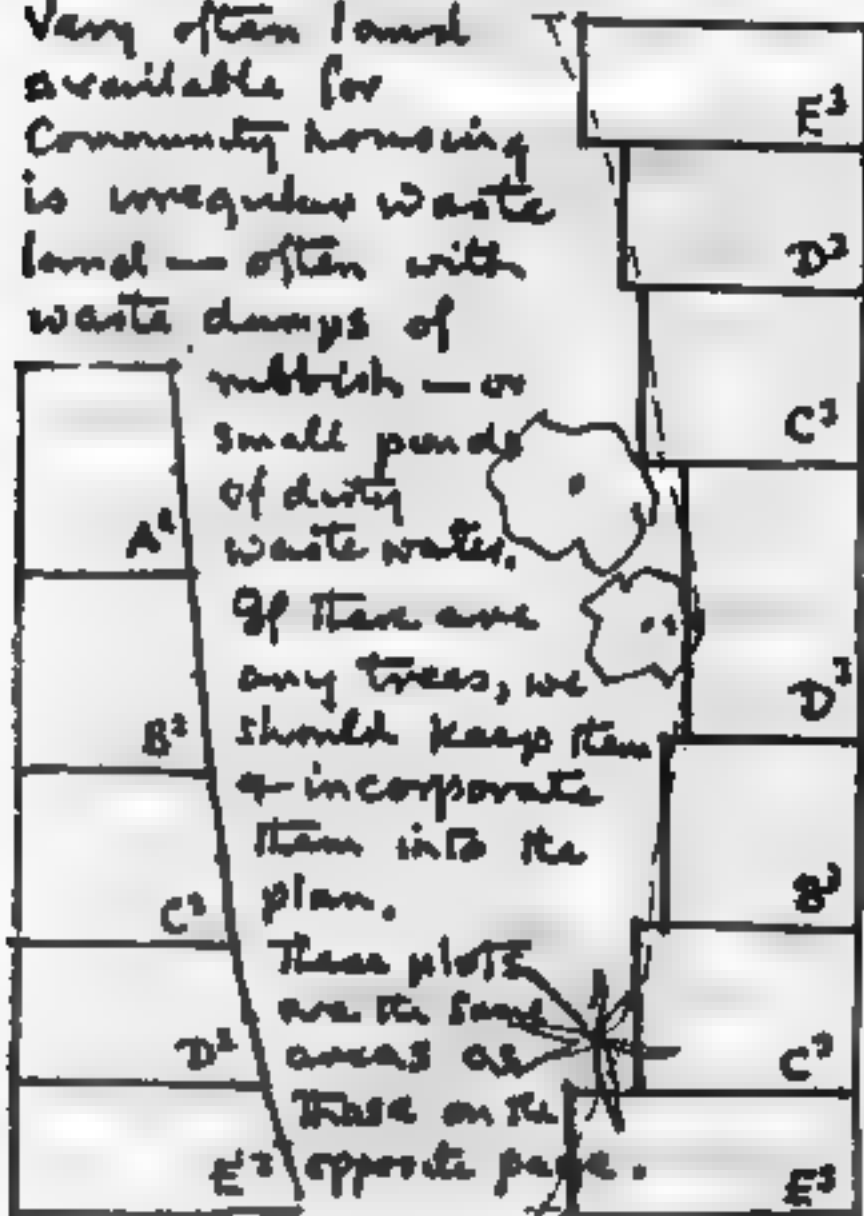
Very often land available for community housing is irregular waste land — often with waste dumps of

rubbish — or small ponds of dirty waste water.

If there are any trees, we should keep them & incorporate them into the plan.

These plots are the same areas as

those on the opposite page.



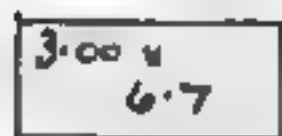
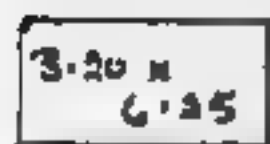
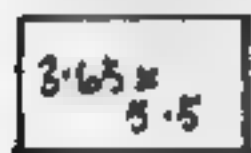
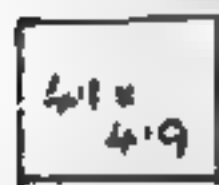
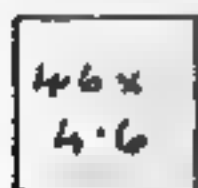
# HOUSE PLAN SIZES

Very often Authorities and Institutions Limit the SIZES of houses they intend to build: Sizes such as  $20m^2$ ,  $25m^2$ ,  $30m^2$  etc.

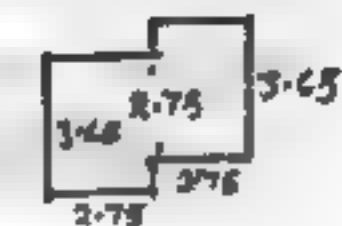
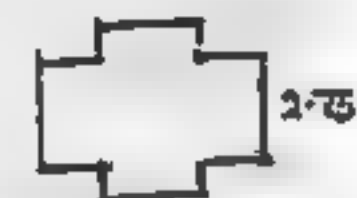
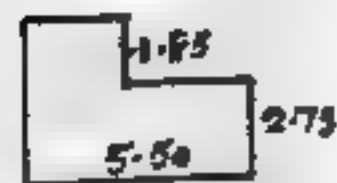
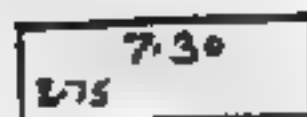
The general immediate reaction of planners and beneficiaries is "Horror! What can you do in  $20m^2$  — a mere  $4m \times 5m$ ! and Then we get accused of putting up rows of identical little concrete boxes — & call them houses....."

The following pages are to  
Show that such small areas  
can be in many different  
shapes — for example  
on the following page  
Twenty different shapes  
are shown — & all are  
approximately 20 m<sup>2</sup>.  
Obviously, the same  
variety can be given  
for other sized houses.  
The main object of these pages  
is to show that one  
PROTOTYPE house plan  
is INEXCUSABLE.

20 m<sup>2</sup>



20 m<sup>2</sup>



20 m<sup>2</sup> - All these shapes

are about

20 m<sup>2</sup>.

Further

pages

will

show

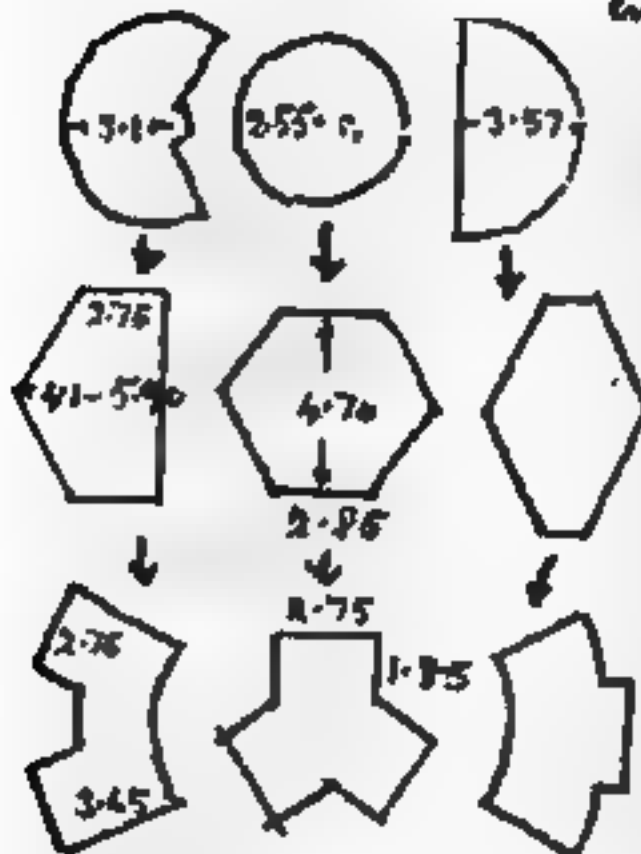
that

each

shape

can

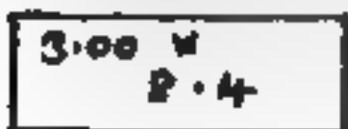
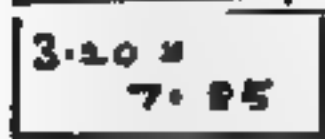
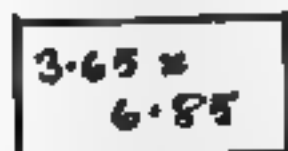
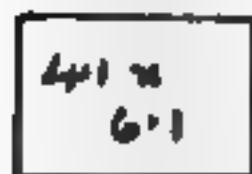
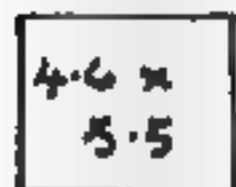
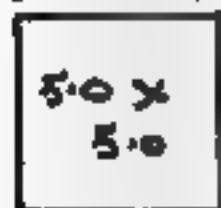
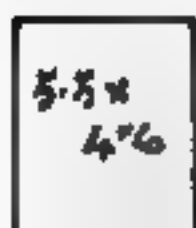
have



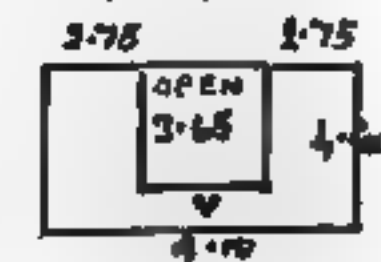
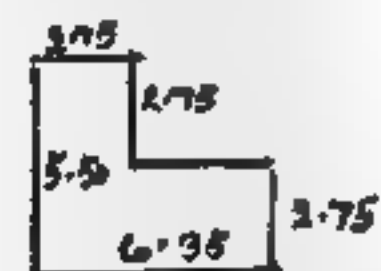
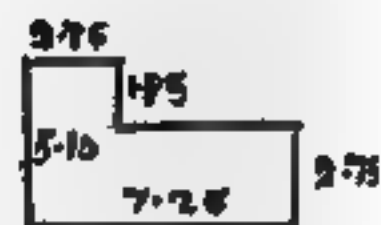
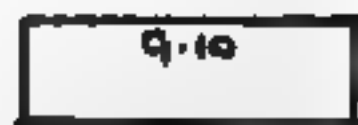
a variety of interior room  
shapes & sizes to suit the  
needs of the occupants.



25 m<sup>2</sup>



25 m<sup>2</sup>

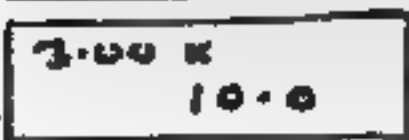
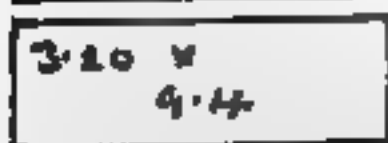
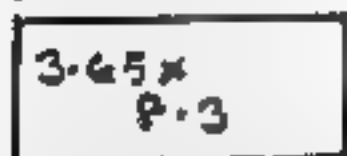
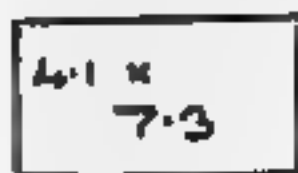
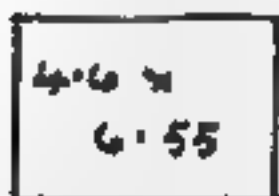
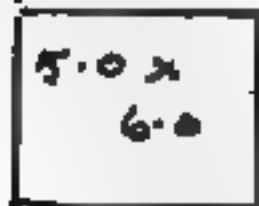




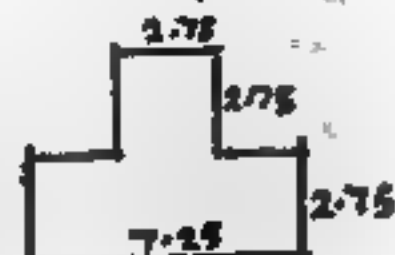
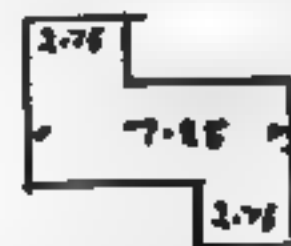
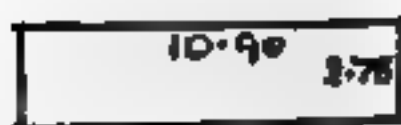
There are a  
 similar variety  
 of shapes  
 when 25 m<sup>2</sup>  
 is specified  
 by the  
 promoters of  
 a community  
 housing scheme

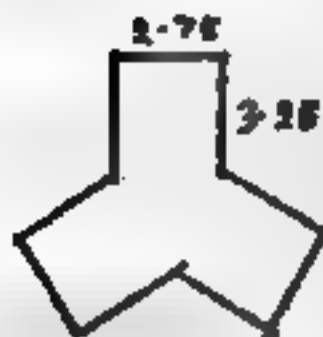
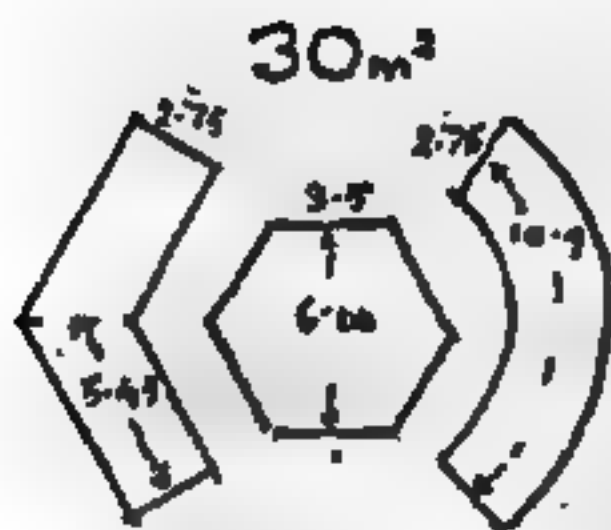
Families vary in numbers, ages,  
 occupations etc - So it is  
 unreasonable to give a  
 community ONE prototype plan.

30 m<sup>2</sup>






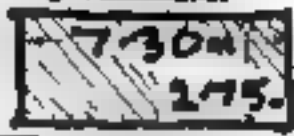
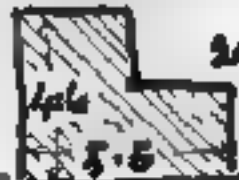
30 m<sup>2</sup>





These  
are a  
similar  
variety of  
plan shapes  
— all of them  
being  
approximately  
30 m<sup>2</sup>.

We can see that there are many shapes which all have the same area -  $20\text{ m}^2$ . However, the lengths of the outer walls vary ↘

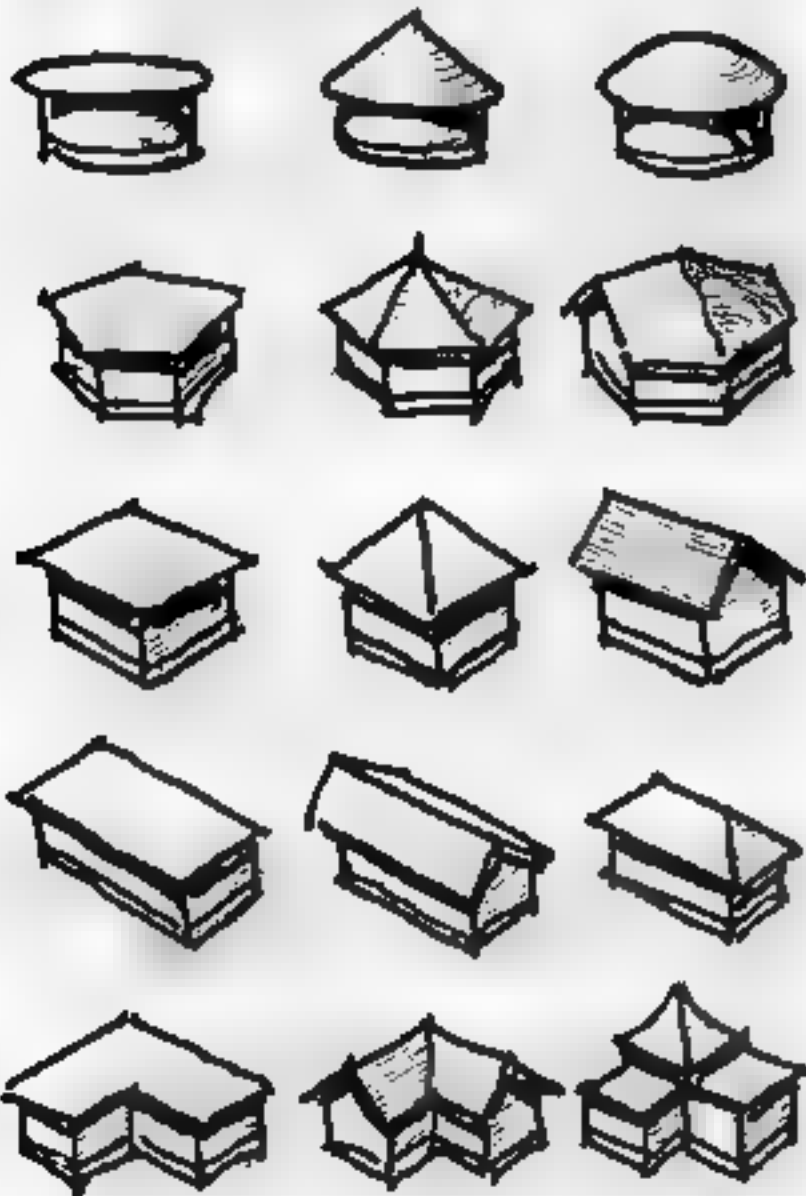
SHAPE AREA $20\text{ m}^2$	LENGTH OF OUTER WALL
 $20\text{ m}^2$	$1570\text{ m}$
 $20\text{ m}^2$	$1650\text{ m}$
 $20\text{ m}^2$	$1788\text{ m}$
 $20\text{ m}^2$	$20.10\text{ m}$
 $20\text{ m}^2$	$20.20\text{ m}$

Consequently the outer wall  
surface also varies for each  
shape - & of course, so does the  
number of bricks used! - Costs!

AREA OF WALL SURFACE	APPROX No of BRICKS
43.20 m <sup>2</sup>	2420
45.37 m <sup>2</sup>	2540
49.17 m <sup>2</sup>	2750
55.27 m <sup>2</sup>	3100
55.50 m <sup>2</sup>	3200

# ROOF VARIATIONS

20m<sup>2</sup> HOUSE AREA



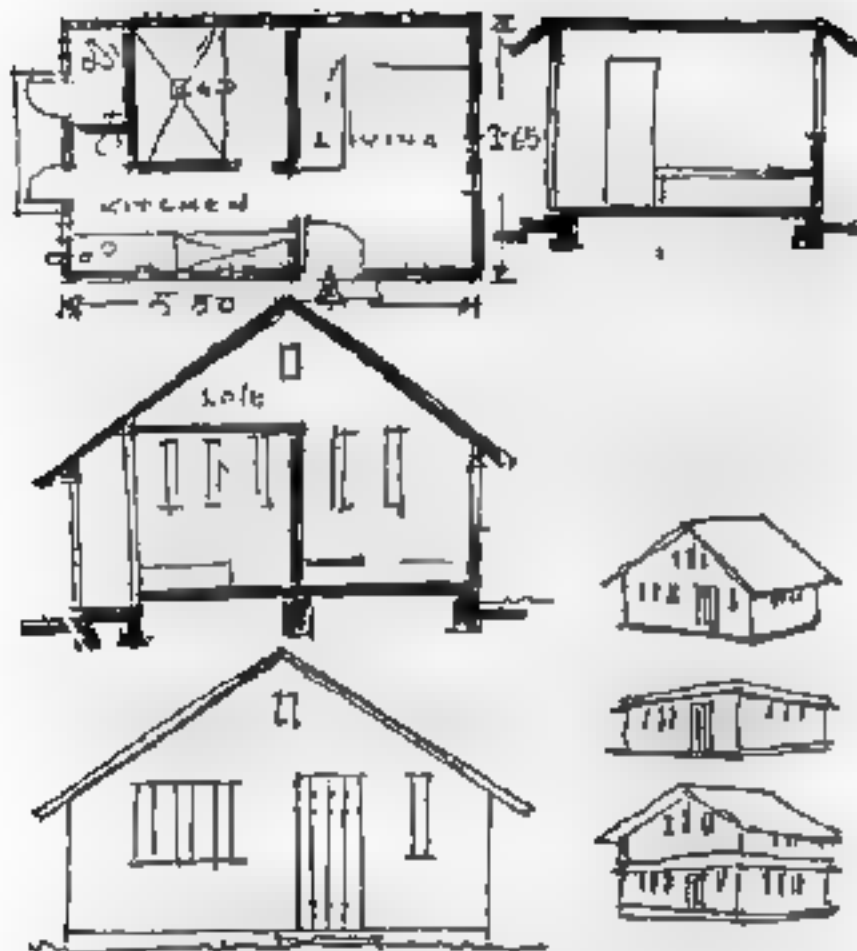
THE CHOICE OF ROOF  
is not just between 'plain'  
or 'fancy' !

The main considerations  
needed are the materials  
available, the climate,  
the rainfall & the wind  
directions, & most  
important - the Traditional  
shape.

The main reason for these  
sketches is to show that a  
community does not have to  
have rows of identical  
boxes.



20m<sup>2</sup>

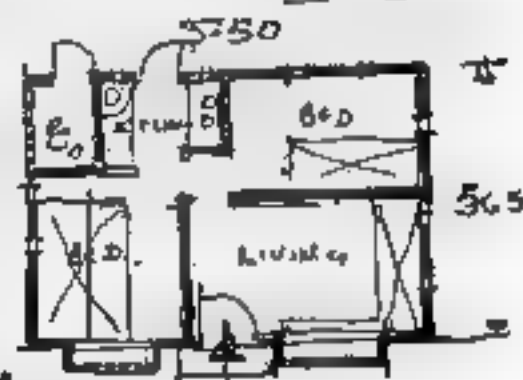
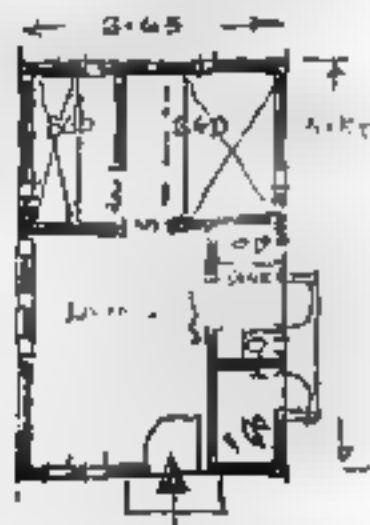


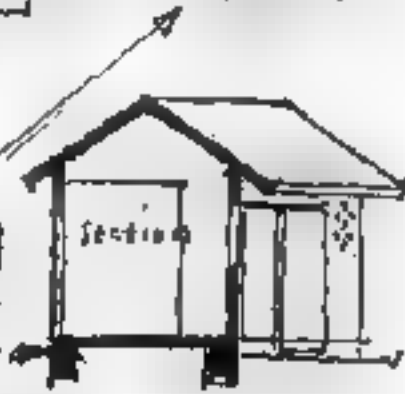
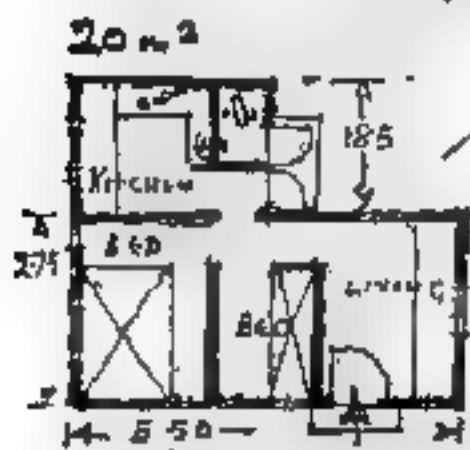
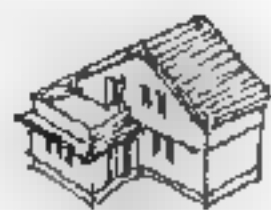
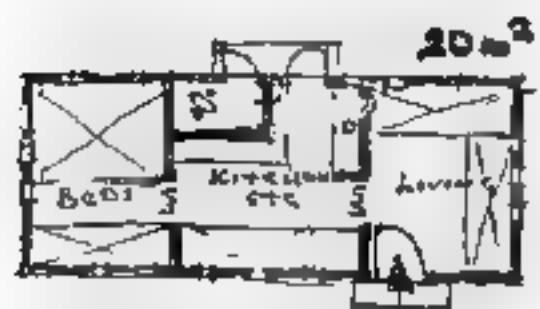
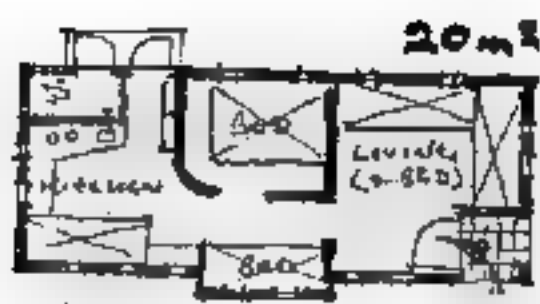
One 20m<sup>2</sup> plan - but  
 Section A has a flat roof which  
 can later take an upper storey.  
 Section B has a sloping roof  
 which allows room now for a loft.

20 m<sup>2</sup>

There  
3 plans  
of a 20 m<sup>2</sup>  
house  
show varying  
internal room  
arrangements

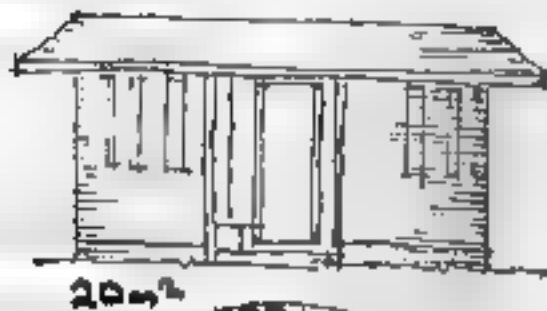
Beneficiaries  
should be  
allowed to  
make their  
own choice  
before  
building  
work starts.



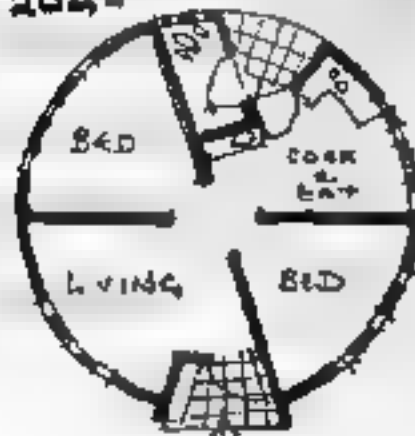


Again, here are four different plan shapes- but the same  $20m^2$  area.

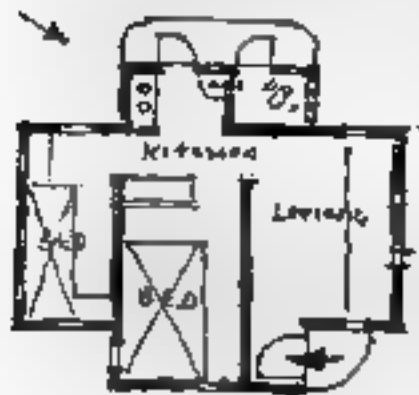
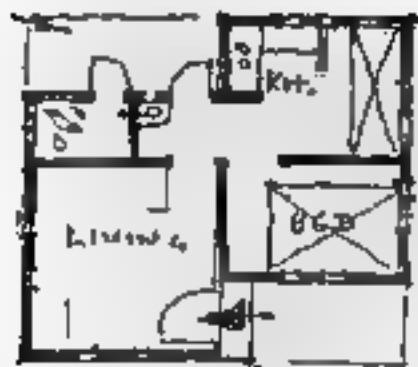
It is worth noting that "corridor" space between rooms is very small in the round plan.



$20m^2$

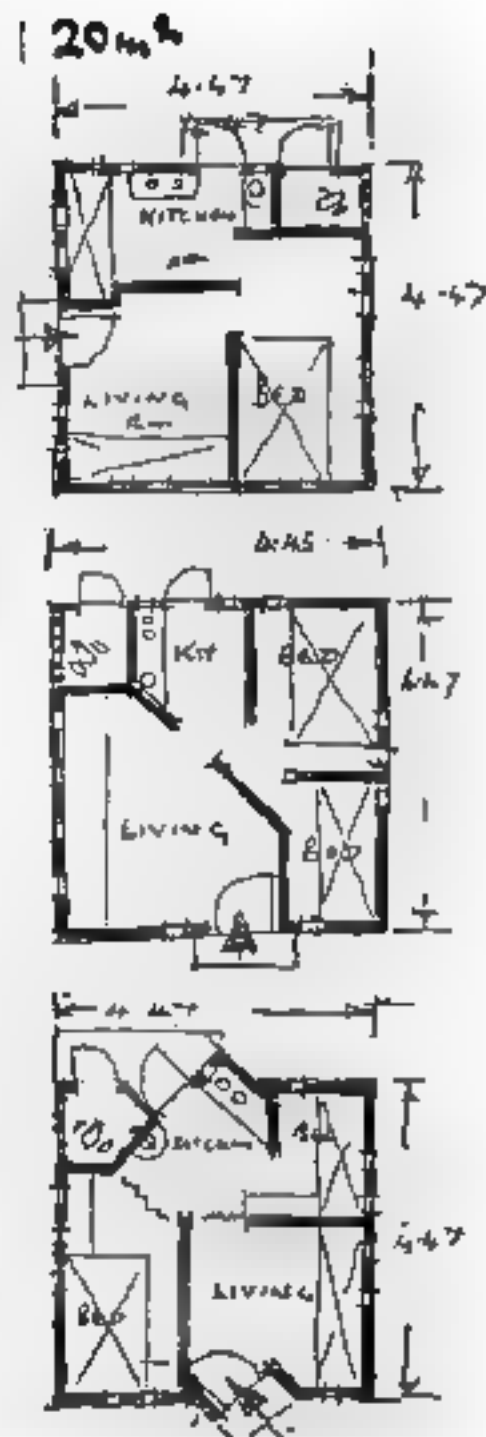


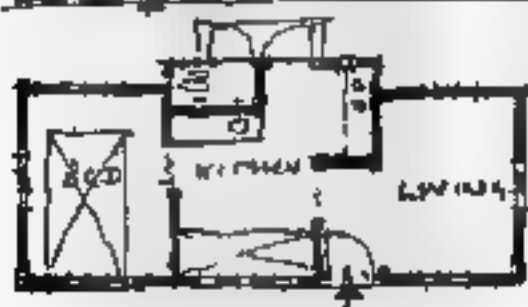
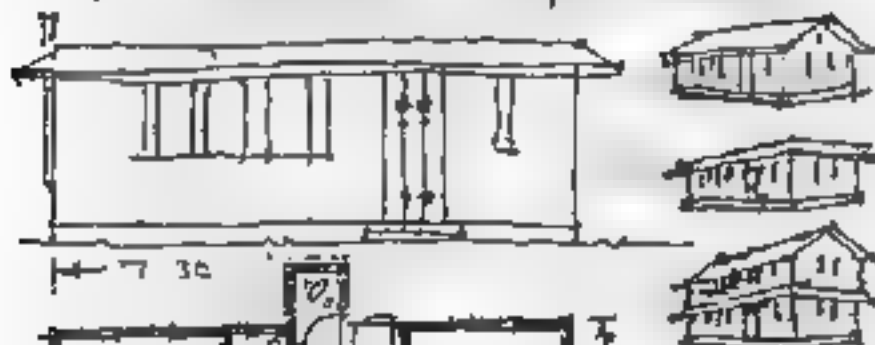
20m<sup>2</sup>



These three plans also have the same area - 20m<sup>2</sup>, but the shape and arrangement of the rooms vary, in each plan, to suit the requirements of the occupying family.

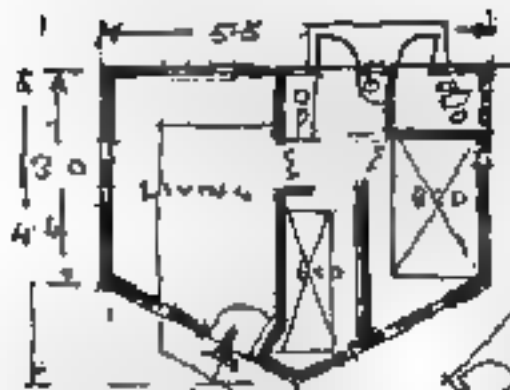
Even if several houses are the same shape, there can be a variety of room shapes and sizes, as is seen with these three square plans, each  $20\text{m}^2$



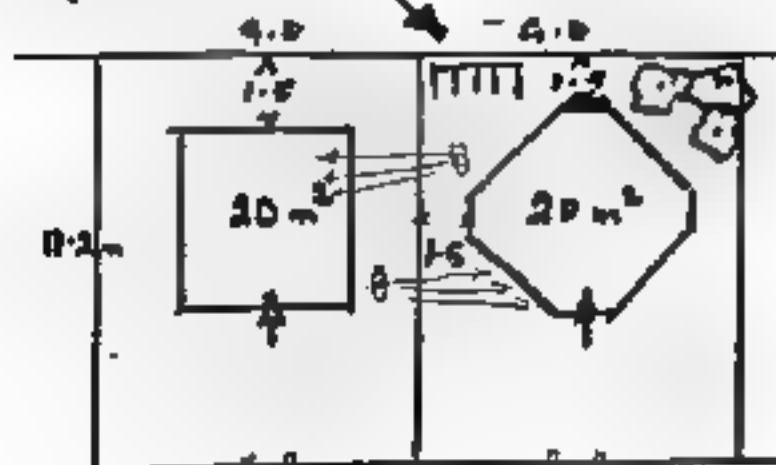


One shape  
and size  
but  
various  
room  
arrangements.

20 m<sup>2</sup>

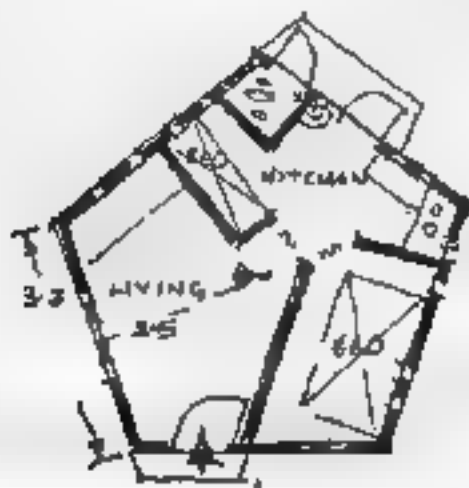
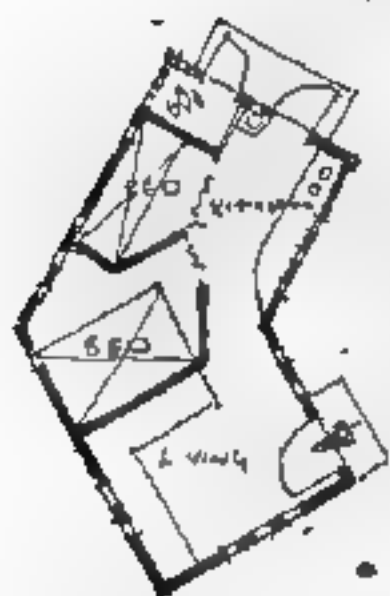
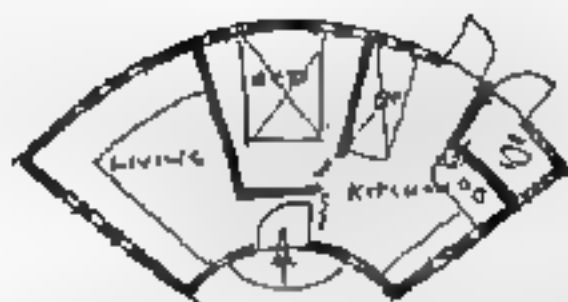


Turning the plan like this → gives more usable open spaces in the rear corners of the plot.

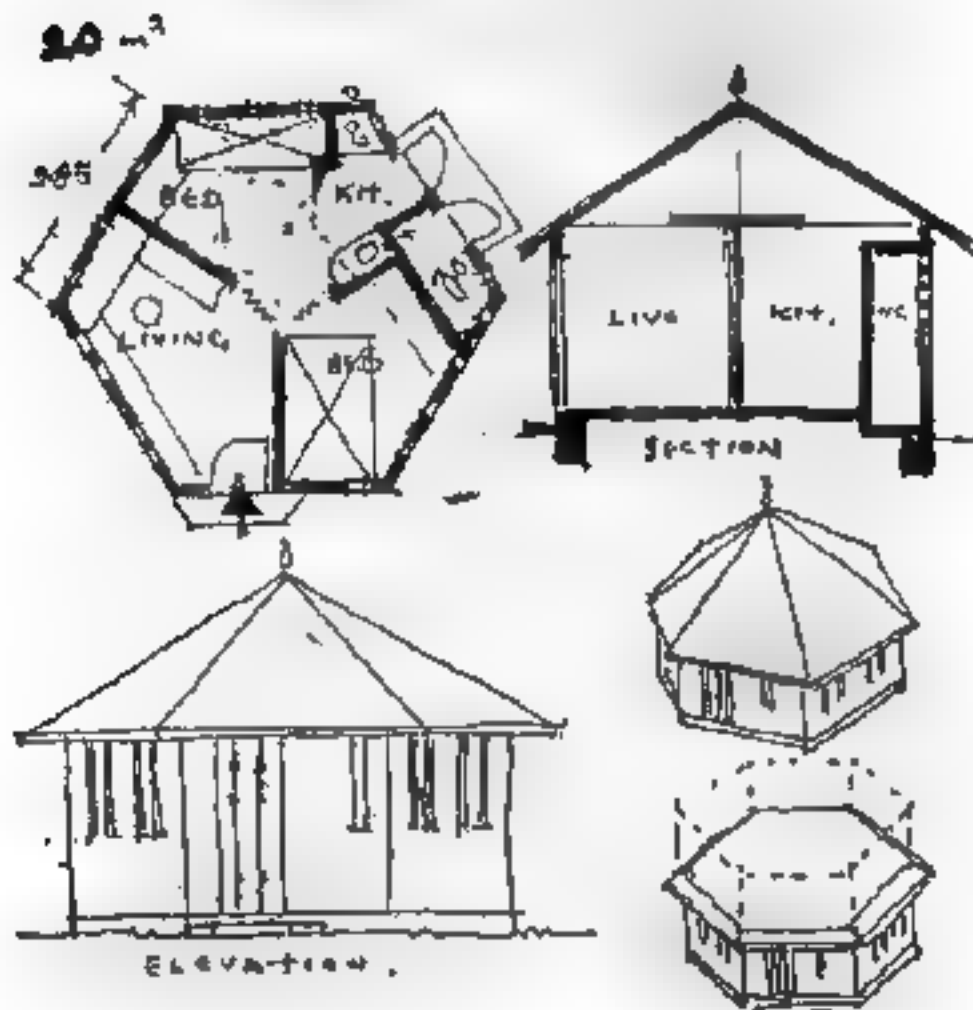




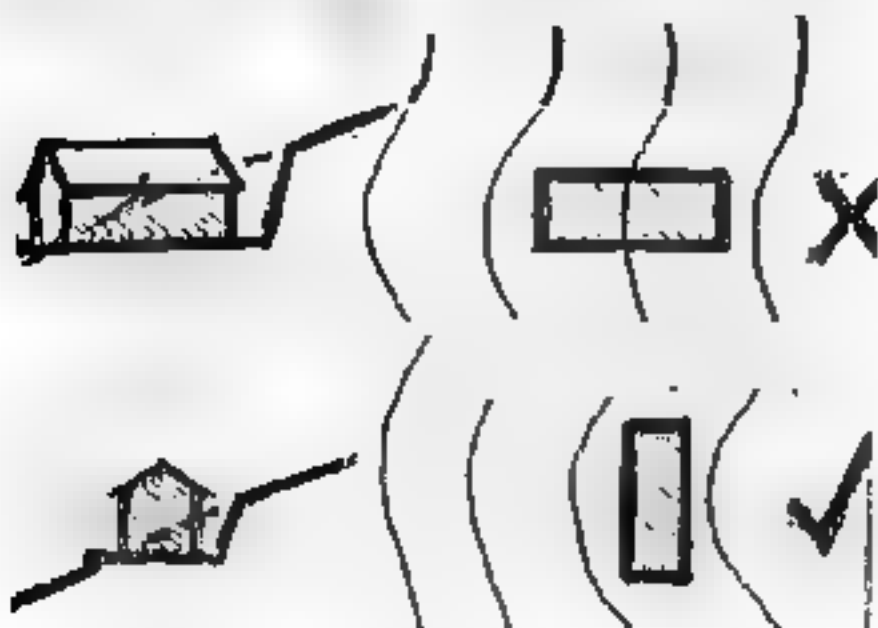
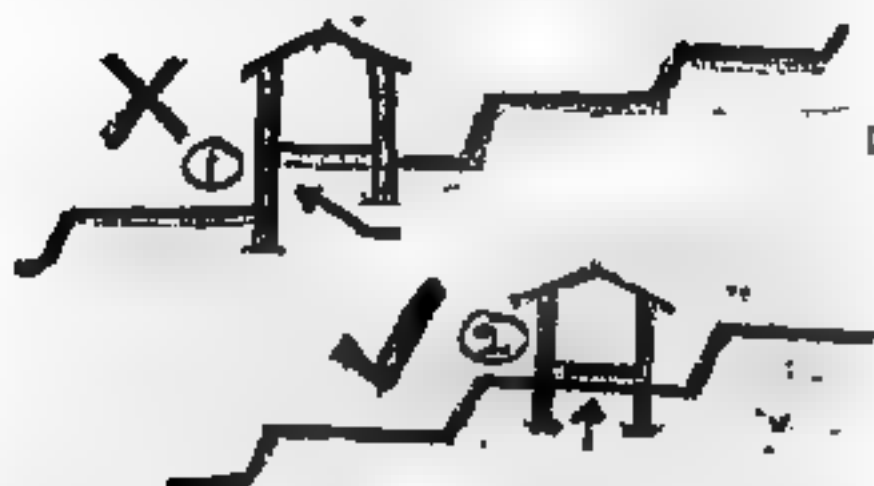
30 m<sup>2</sup>



These plans show odd shapes  
which may better fit into odd,  
or corner shaped plots.



# SLOPING SITES

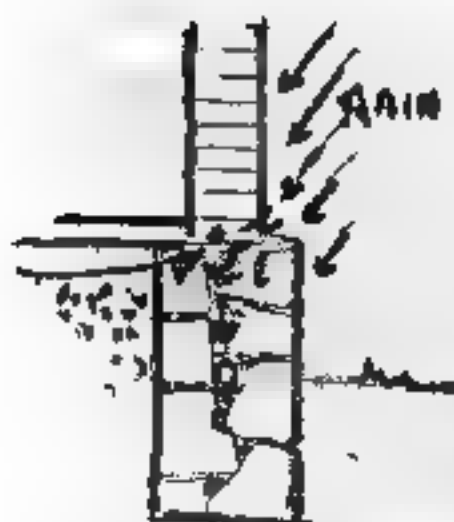


Where land is steeply sloping,  
or terraced -

1. Don't build on the outer edge  
of the terrace. You would need to  
build a strong expensive retain-  
ing wall
2. Build the house along  
the middle of the terrace &  
use a long rectangular plan,  
not a square one.
3. If the terraces are narrow  
it is sometimes possible to  
build a 'stepped house'



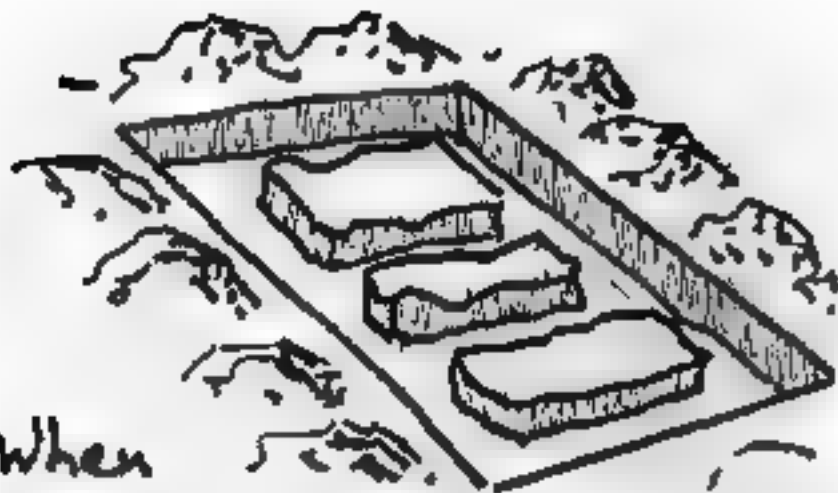
# FOUNDATIONS



For small houses (and especially for single storey ones) there is no need to build the upper brick walls over the middle of the foundation wall.

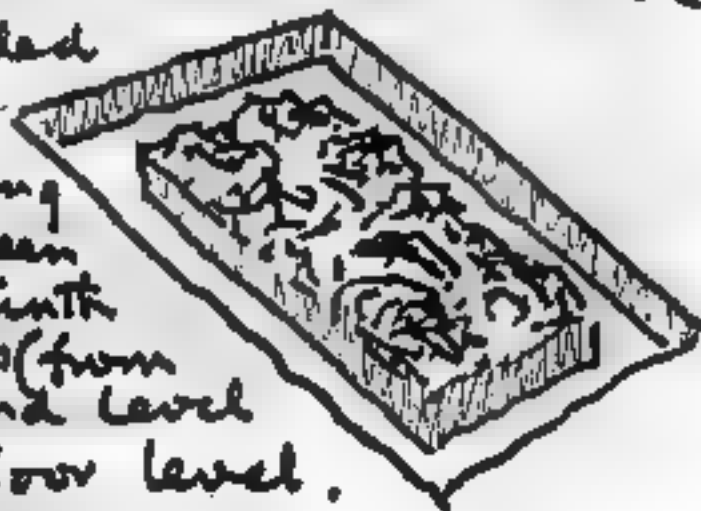


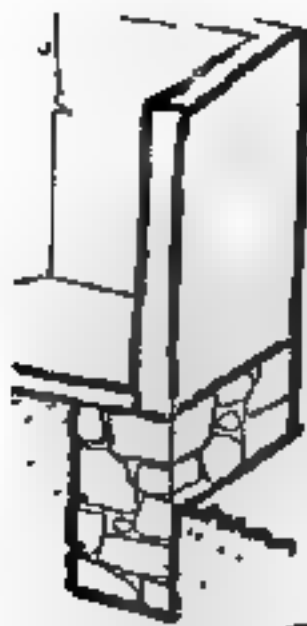
Set the upper wall over the outer half of the foundation walls. It prevents rain seepage.



When digging out the trenches for the foundation walls, do not scatter the soil all over the place. Keep it altogether in the middle as it will be needed

for infilling between the plinth walls (from ground level to floor level).

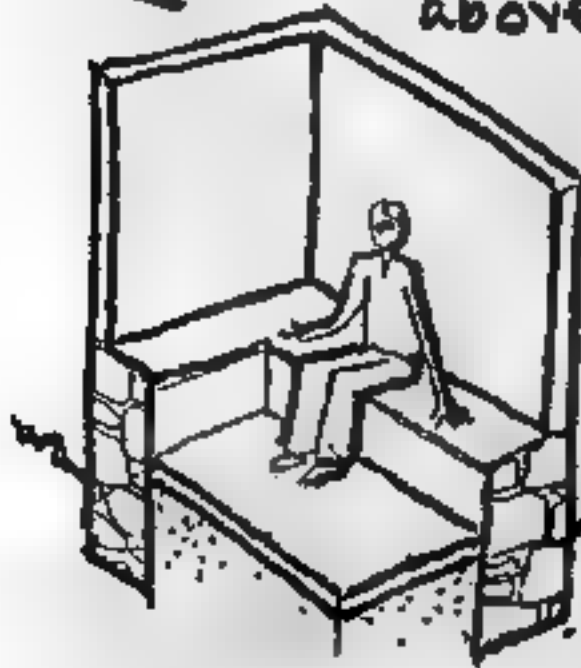




## STONE FOUNDATIONS

usually stop at  
floor level —

(30 or 40 cm  
above ground  
level)



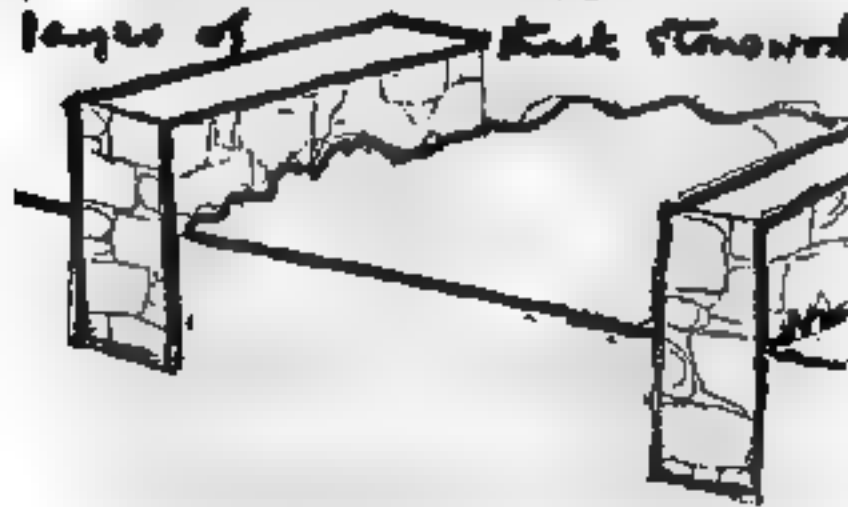
Take them  
45 cm  
higher &  
you have  
a ready  
made bed  
or seat!

## FOUNDATIONS.

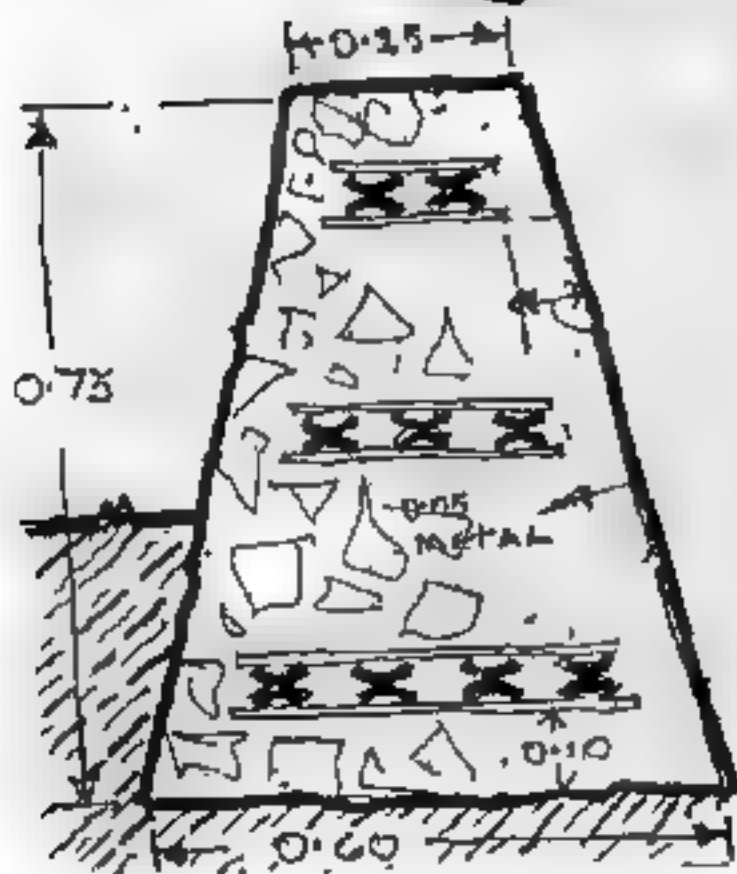
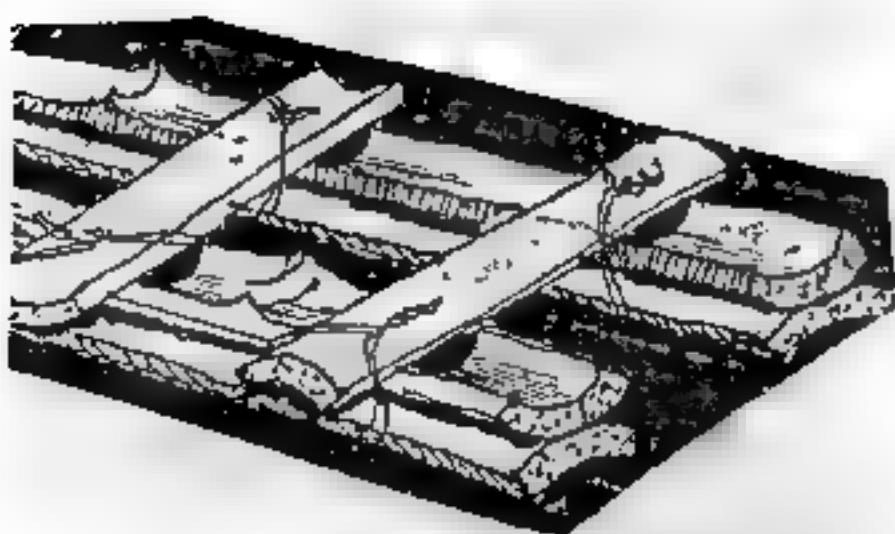
When soil is poor & soft - it is usual to dig a wide trench and cover the bottom with concrete. On this a wide stone wall (50-60) is built & on top of that -



When the soil is strong & hard there is no need for either the concrete or the layer of

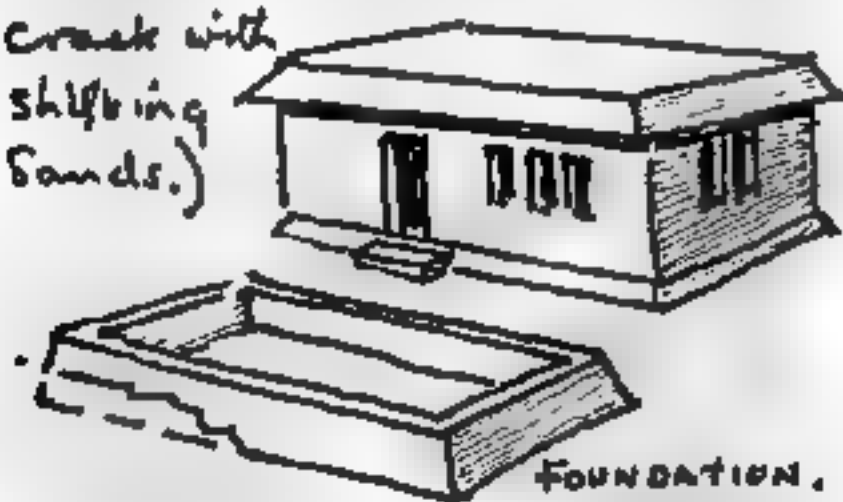


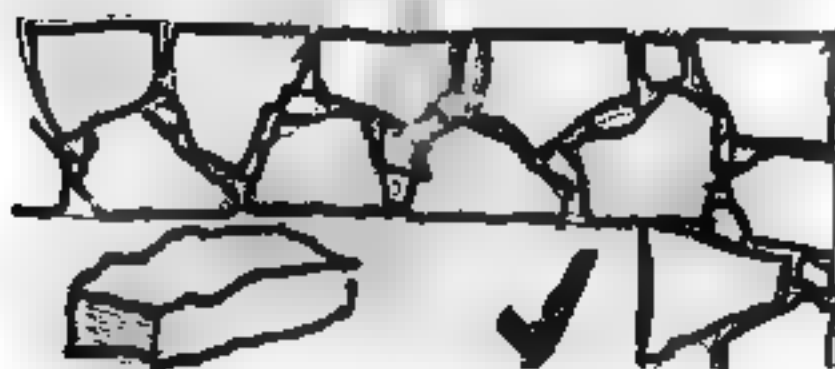
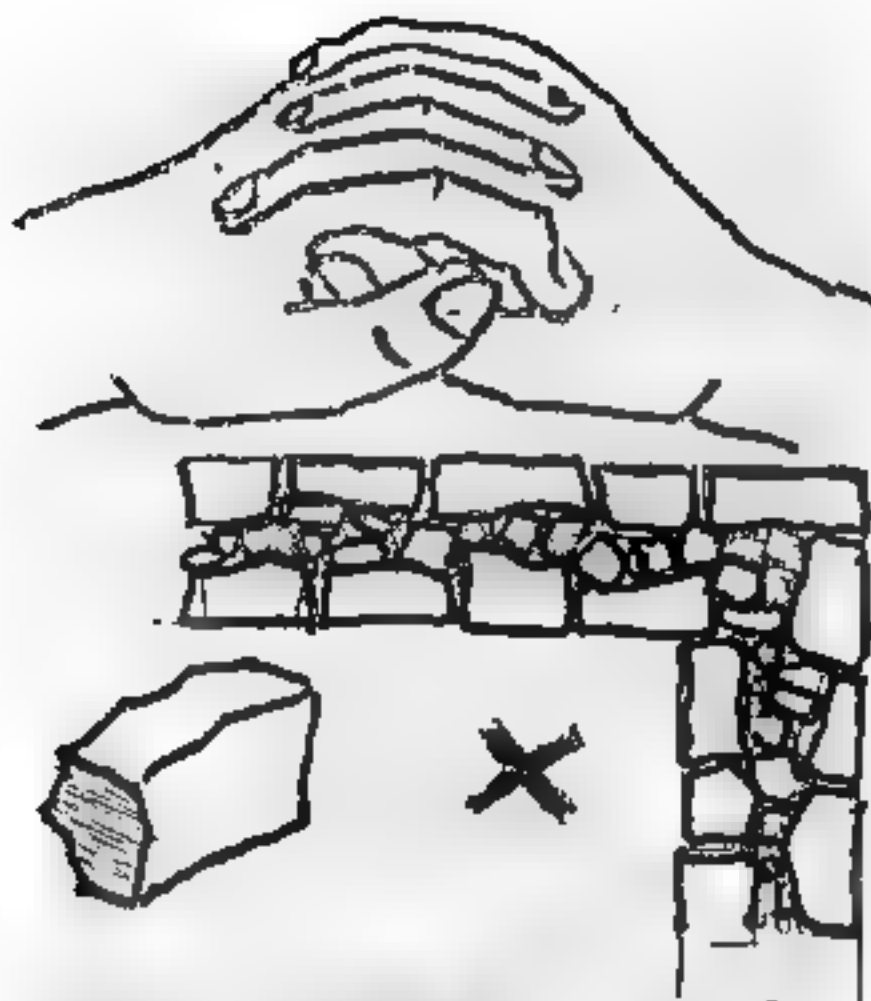




Another use for split building  
BAMBOO in LIME concrete  
is for foundations,  
especially in sandy areas  
along the sea coast.  
Salt & Saline will not affect  
or destroy either the concrete  
or the reinforcement.

(Ordinary foundations will  
crack with  
shifting  
sands.)

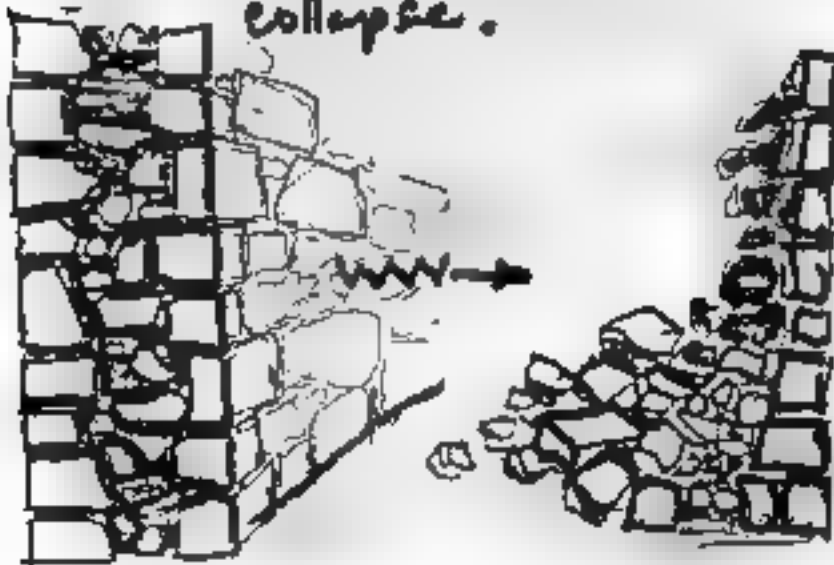


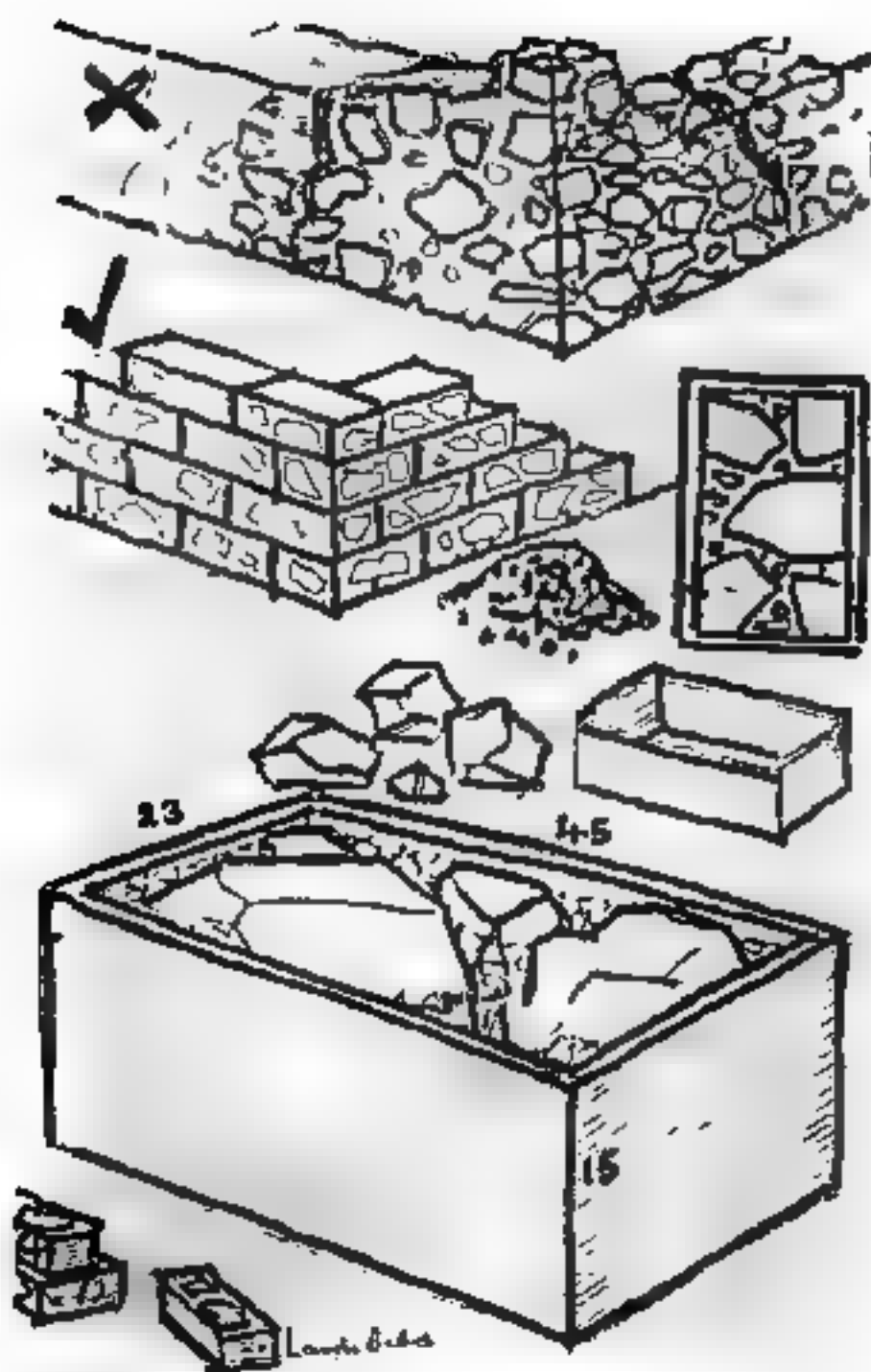


# BONDING

is the very essential art of making BRICKS, BLOCKS & STONES on Both sides of a wall interlock with each other.

Masons often want to make an impression of Their wall being made of large flat faced stones but any extra pressure from weight, winds, earth tremors etc & The wall will crack & collapse.

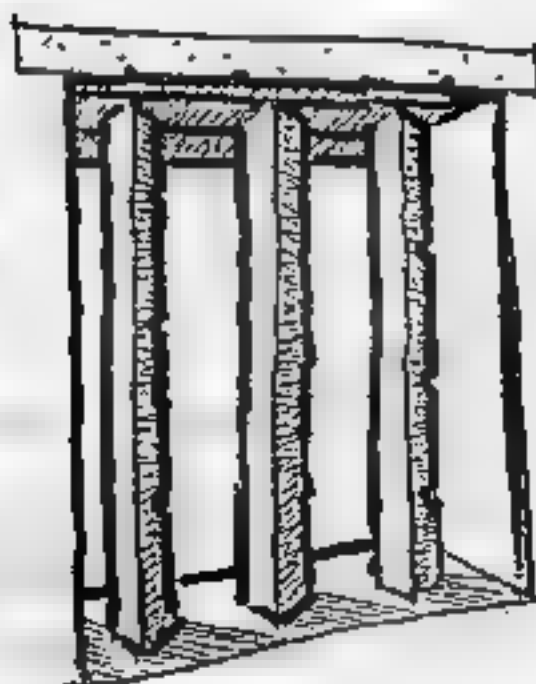
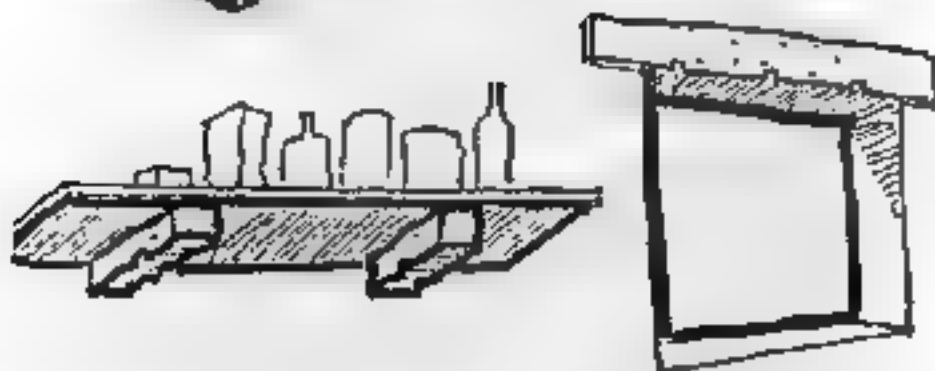
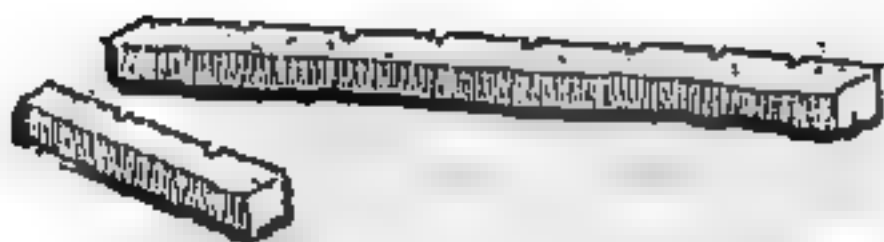




In some districts stone is available, but only in small irregular lumps. These make very poor walls with no possibility of good bonding. Cracks soon develop.

Make a metal (or wood) box (without top or bottom) about 45 cm long 23 cm wide and 15 cm high.

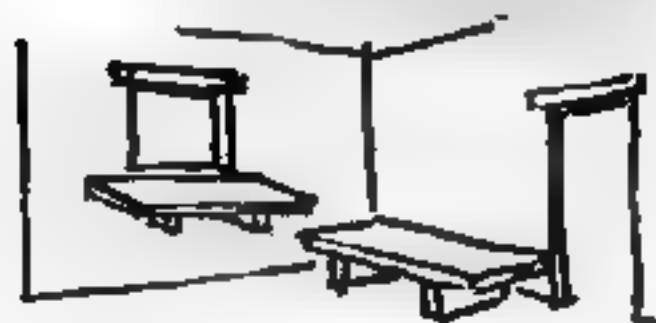
Place in it the larger stones & then fill in, all round, with concrete made of the small stone. After drying & removing the box you have an excellent building block.



# SPLIT STONE

In some districts granite is split from large rocks to give posts & slabs.

You can incorporate these stones as lintels, shelves, window 'grills' and child-proof furniture. Short broken posts can usually be had at very low prices.





Mud walls  
must be  
protected  
from water

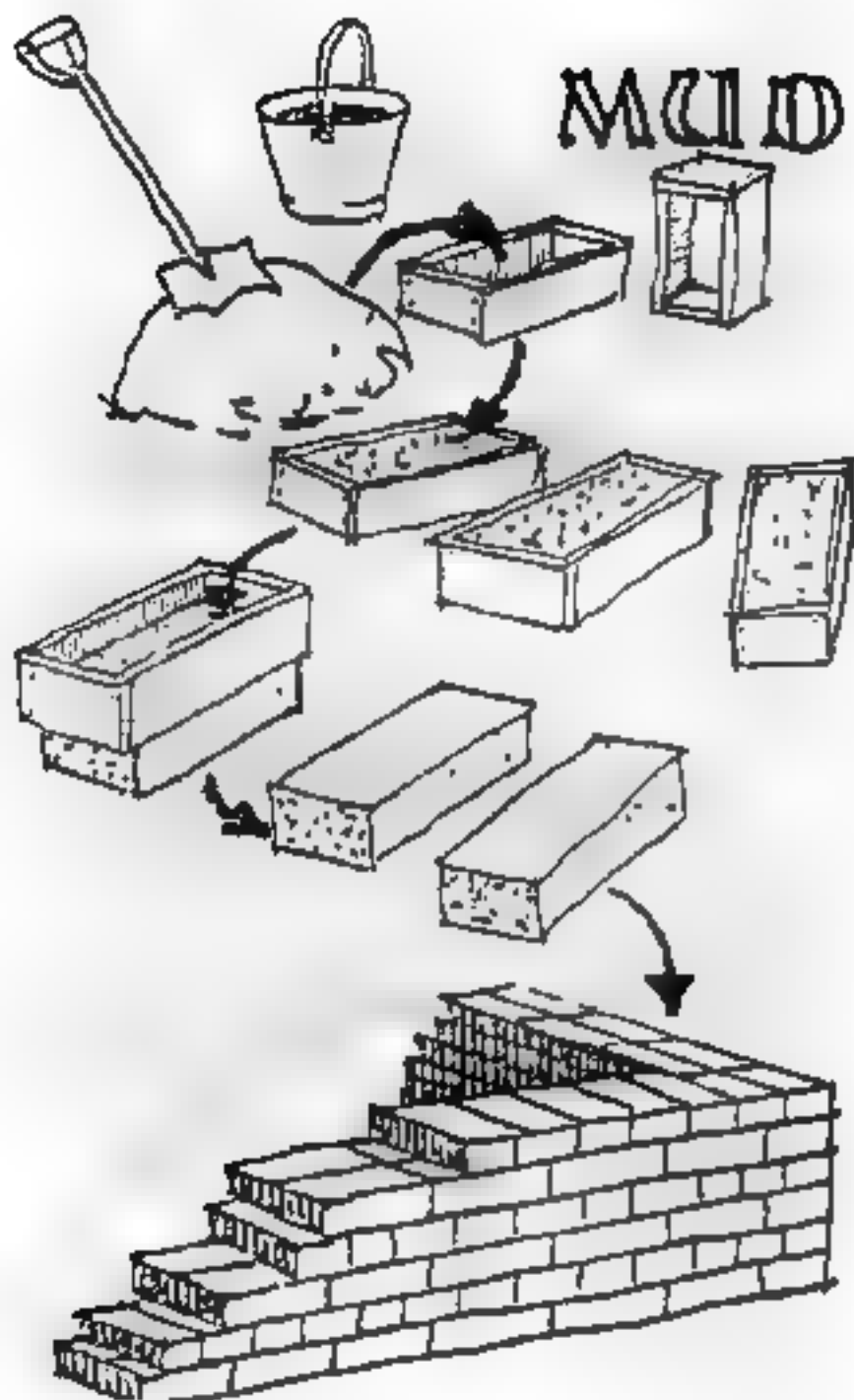


Overhanging  
eaves act as an

umbrella must



Protect the base of mud walls  
from roof rain water  
splashing up from the  
ground.



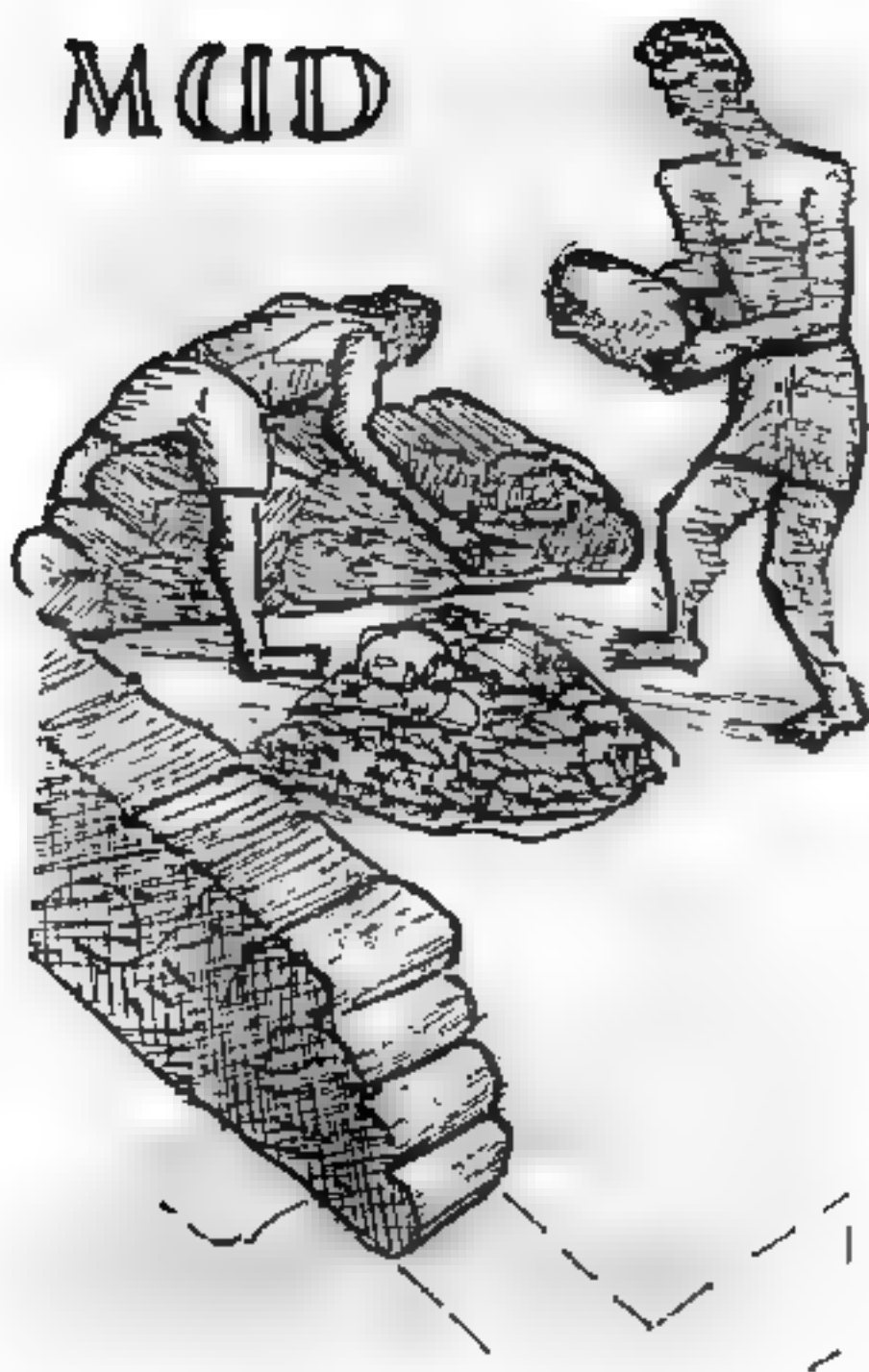
## ADOBE <sup>OR</sup> SUN DRIED BRICKS.

This is a very old, well-tried  
& tested mud brick system  
common in many parts of  
Kerala.

If properly made, These  
mud sun dried bricks are  
capable of being used for a  
two storey house.



MUD



# COB

Mix soil with only a little water — put up as much as you can in your two hands and make a 'roll' —



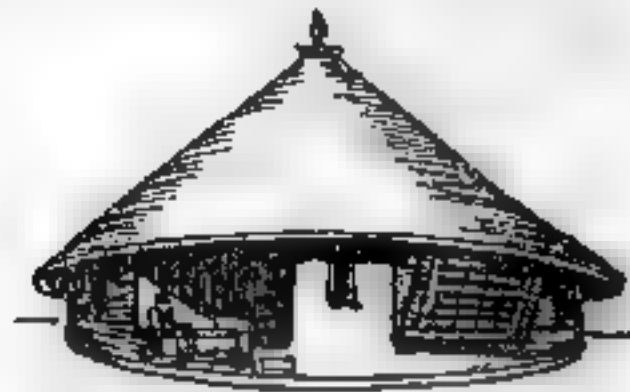
Place these rolls closely together in rows.



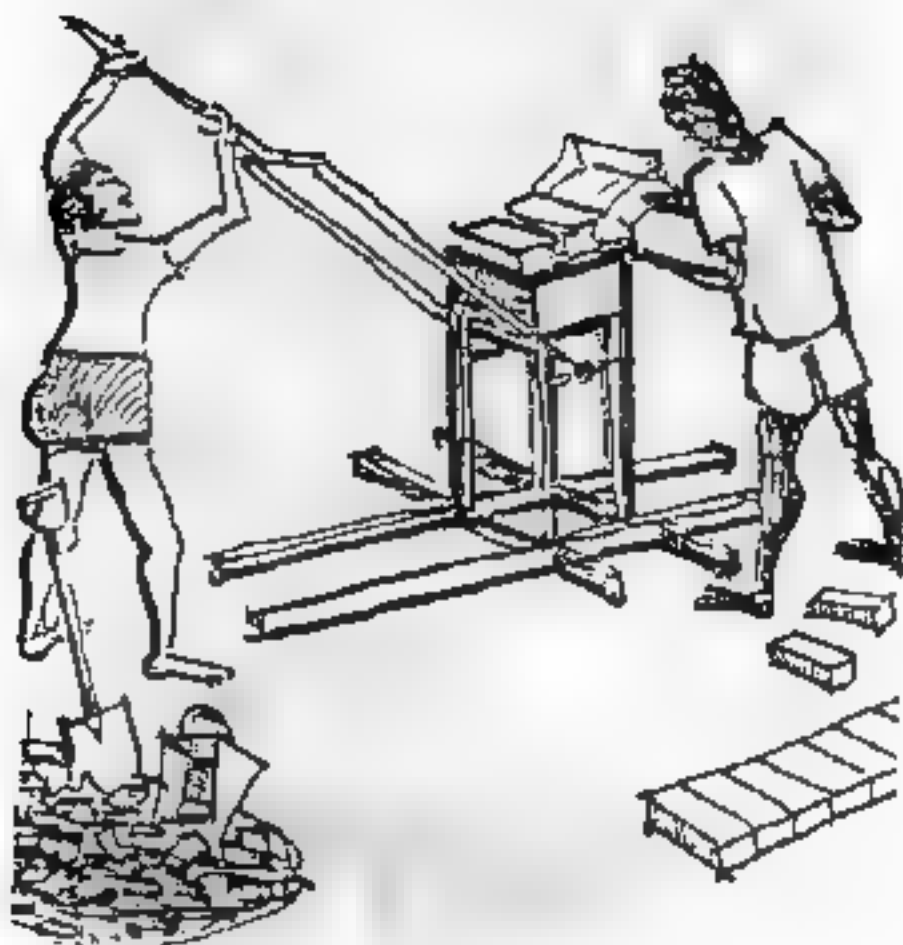
Then Smooth over its ends.

Anyone can make this sort of wall but you cannot make a high wall.

It is very good for curved or circular walls.



# MUD

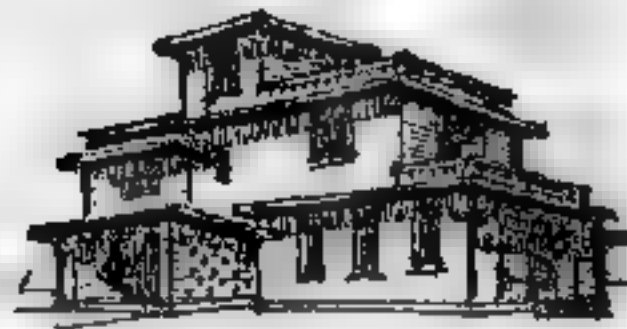


# PRESSED BRICKS

A hand operated machine compresses the earth into hard, smooth, strong bricks

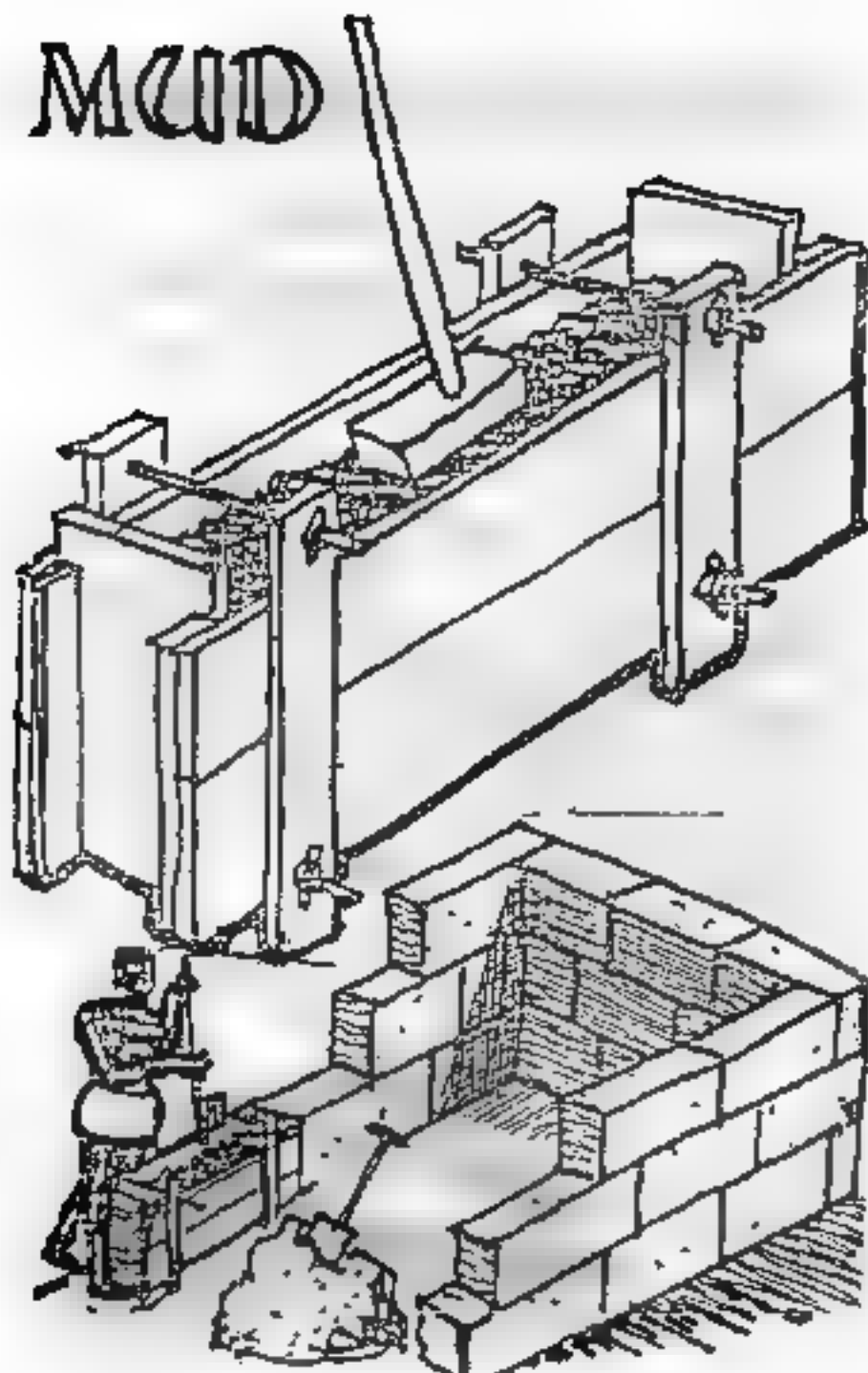
(the machine can be owned by the community or panchayat)

these can be used for even three storey houses, tho' each storey must be protected from rain by overhanging slabs.





MUD



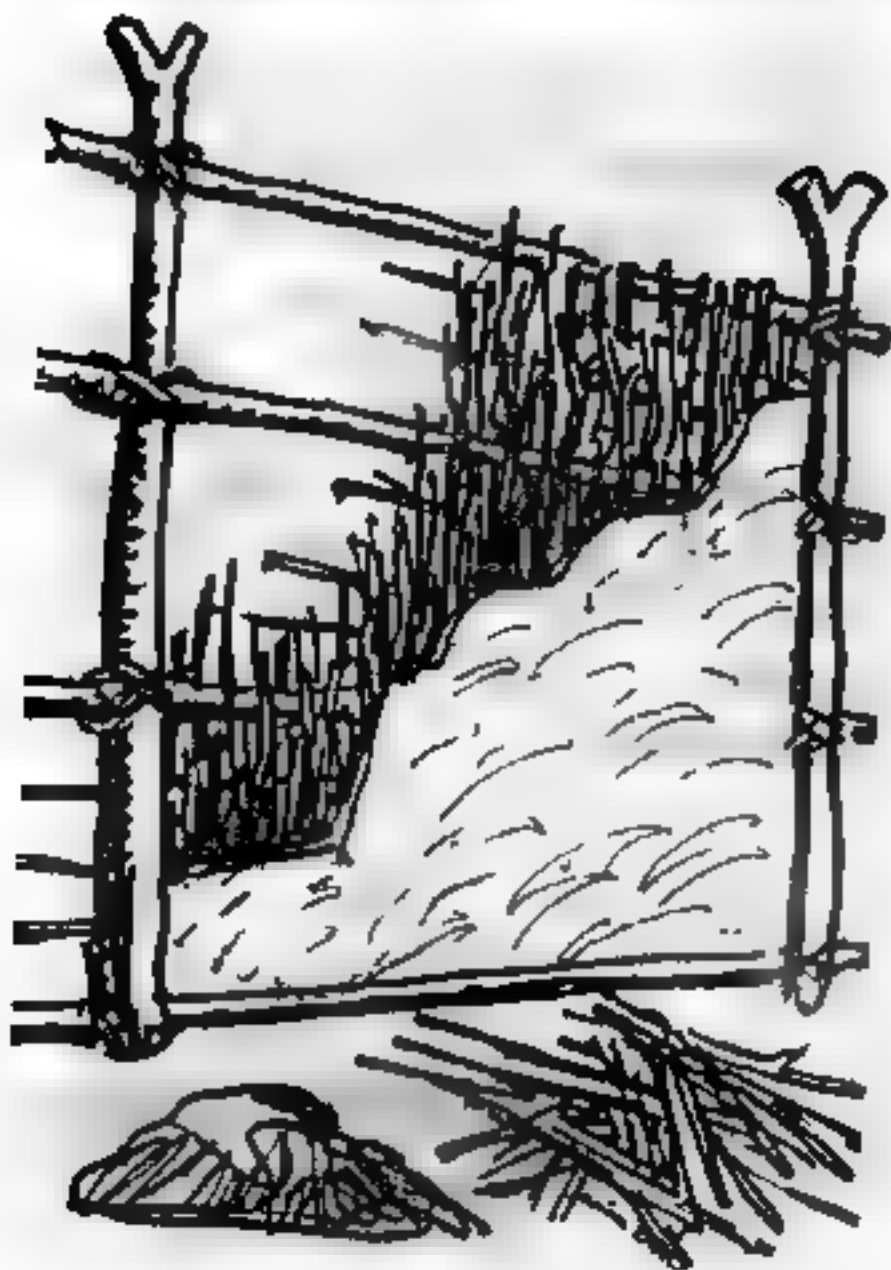
# PISE (RAMMED EARTH)

With a properly made frame (which can be taken to pieces) rammed earth makes a very strong wall.

It is especially good for large, low, solid looking buildings & it can take the weight of heavy roofing such as reinforced concrete.



MUD



# WATTLE & DAUB

This system of using mud for house building is more usual in India's Eastern States.

It is mainly used in Bamboo growing areas

It is particularly good & 'safe' in areas prone to earth tremors

It is also adaptable to any shape of building



Straw  
Chaff  
Cowdung



# Rural stabilisers



sisal  
cacti  
etc.

plant  
juices

# LATERITE

Laterite is found in many parts of Kerala (& in other states too). It is a natural, compressed earth & uses no energy (fuel) at all.

Unfortunately, unlike Soil & Sand, once 'mined', the quarry remains as a big hole in the ground.

It is also very heavy & lifting it up to masons working at high levels is both 'labour intensive' & slow, hard work.

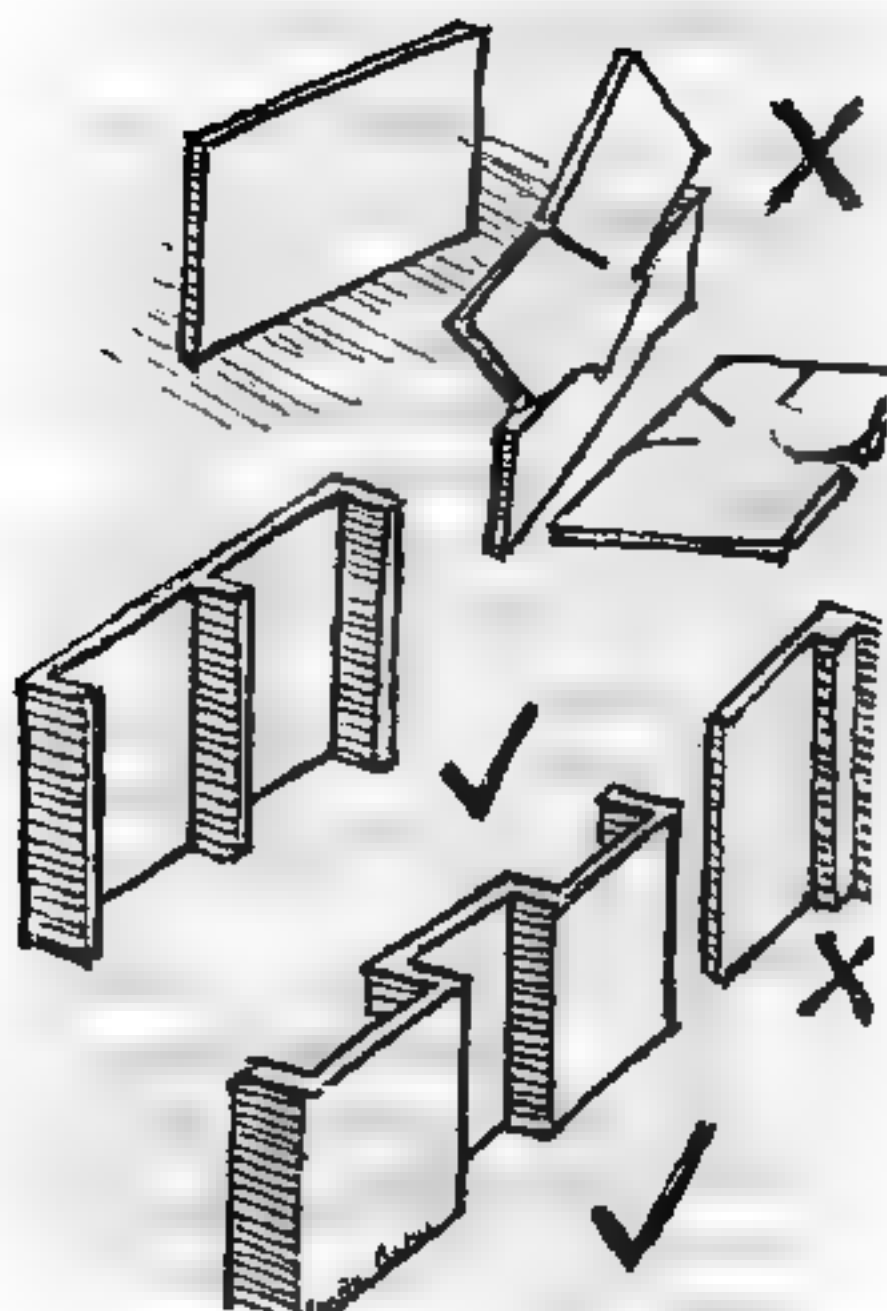
It is, however far more acceptable than cement blocks.

# CEMENT BLOCKS

These are currently used very extensively. This is NOT acceptable when building for thousands & millions. Cement is a highly ENERGY (Fuel) INTENSIVE item & India is short of energy & has to import much of it. The cement used in a Block Wall is considerably more than the comparatively small amount used in a Brick wall.

Blocks are very heavy & lifting, especially above waist level - slows down construction time & calls for more labour. Bricks are easily thrown up to any height.

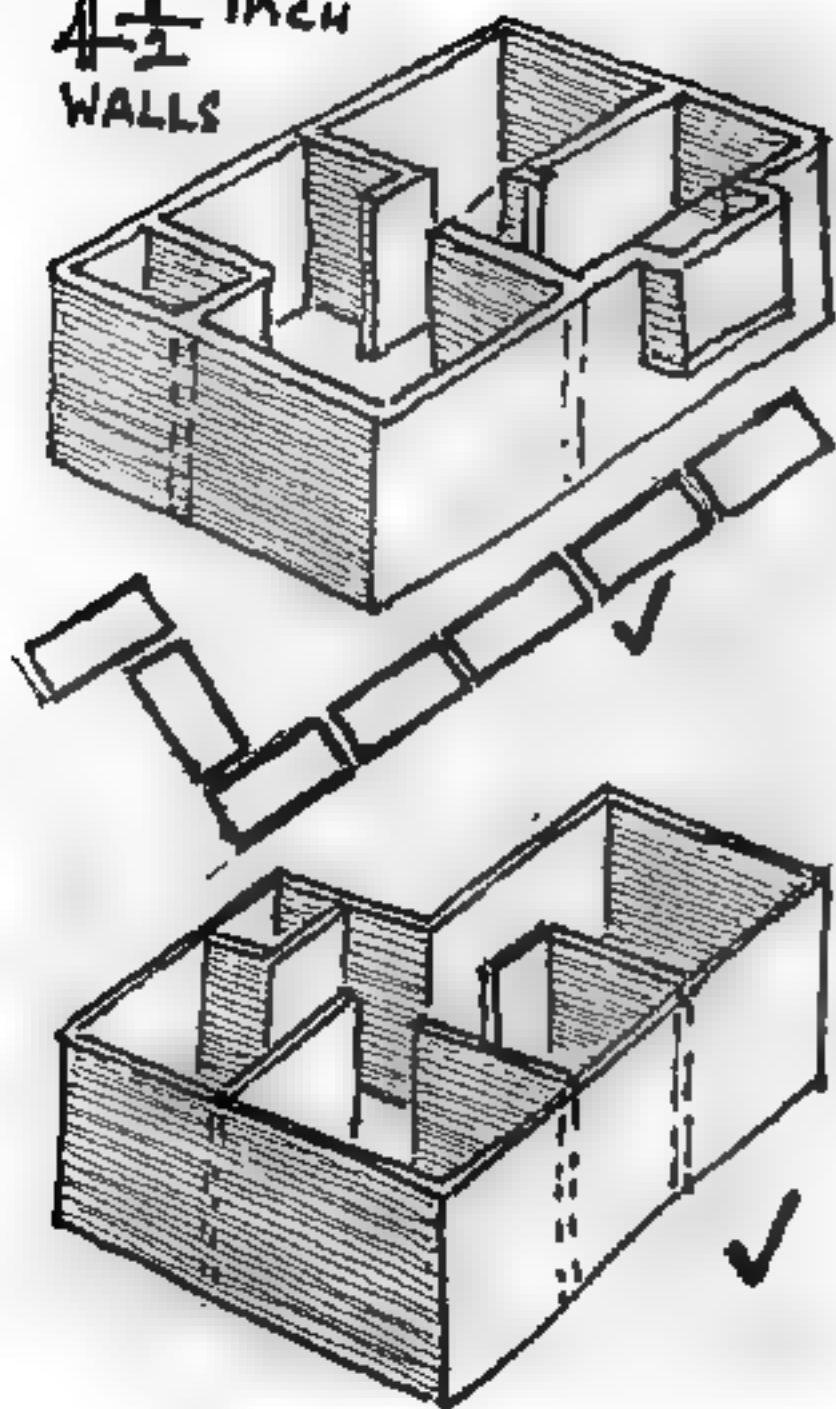




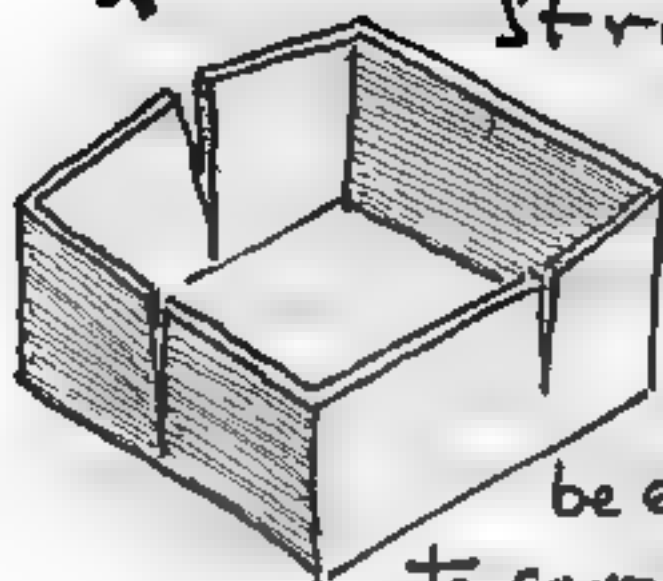
## 4½ inch or HALF BRICK WALLS

if properly & well constructed & bonded, in short stretches, (say up to 2m), are safe, strong, and perfectly capable of carrying an upper storey. A good roof overhang (50cm) will protect the walls from driving rain & damp.

4-1/2 INCH  
WALLS

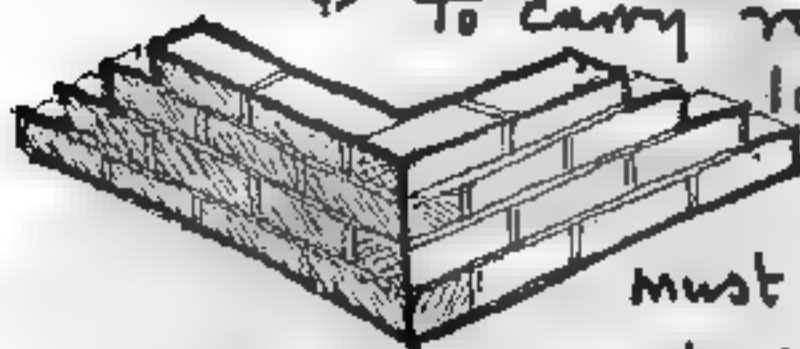


X

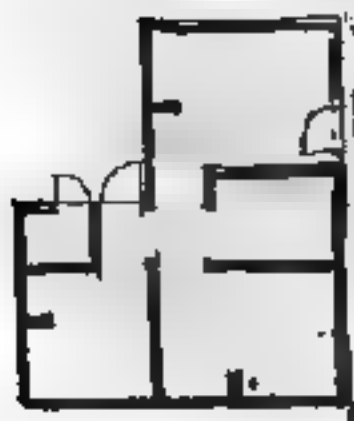


Straight,  
Long,  
thin  
walls

cannot  
be expected  
to carry roof  
loads.



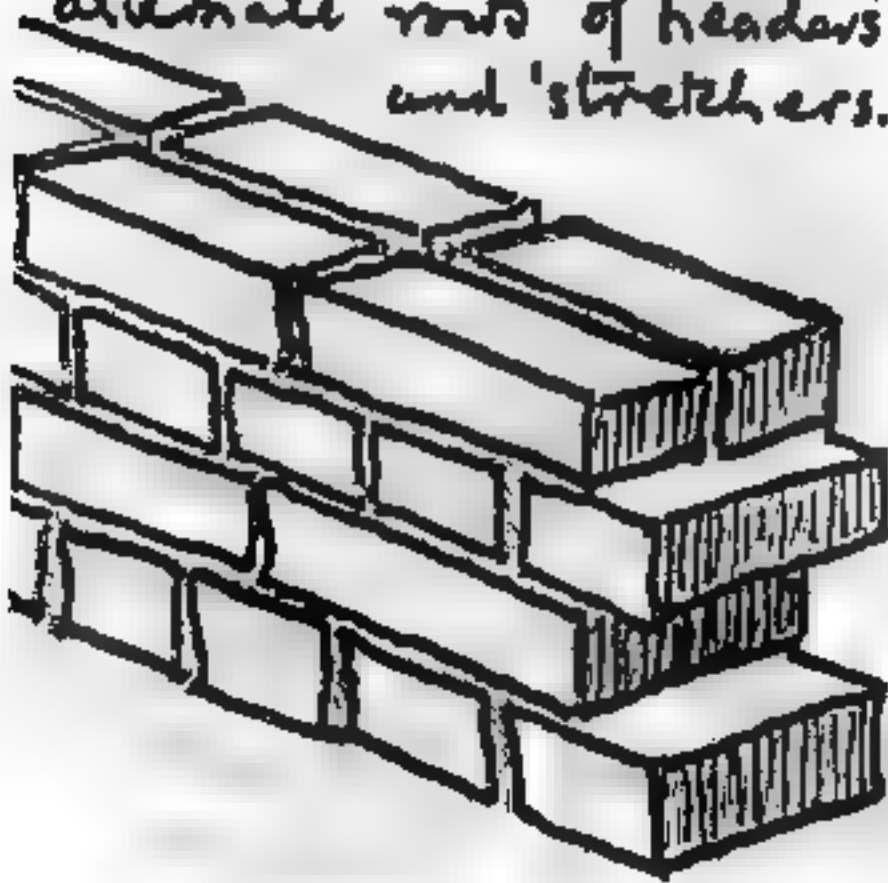
4  
must be  
expected to  
bulge, crack  
& break, if  
not well  
planned.

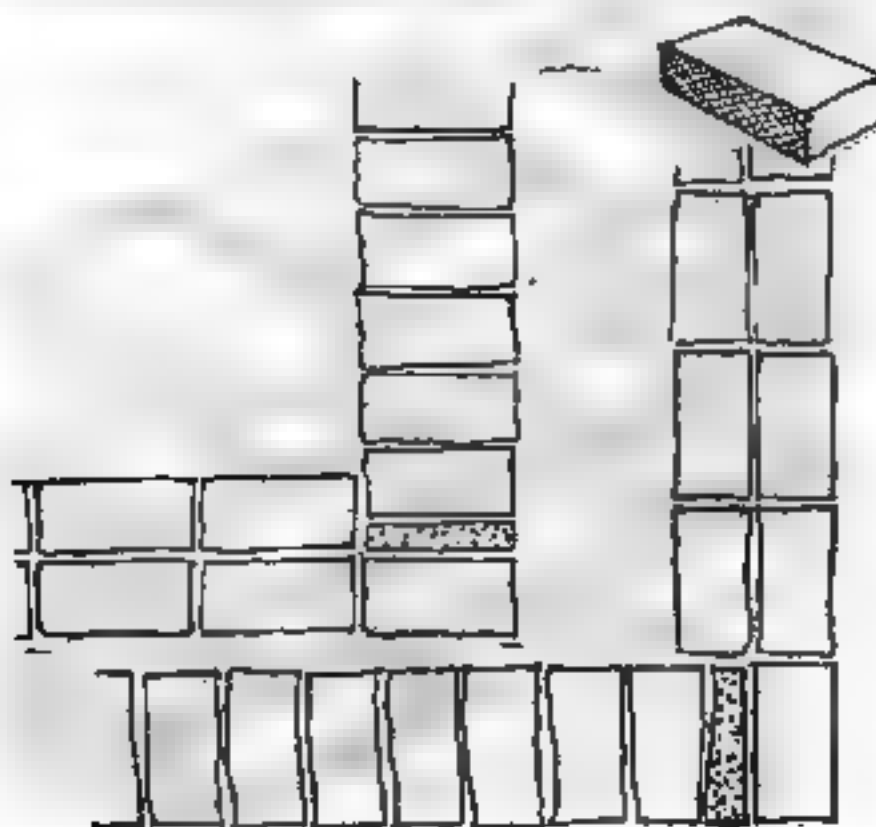
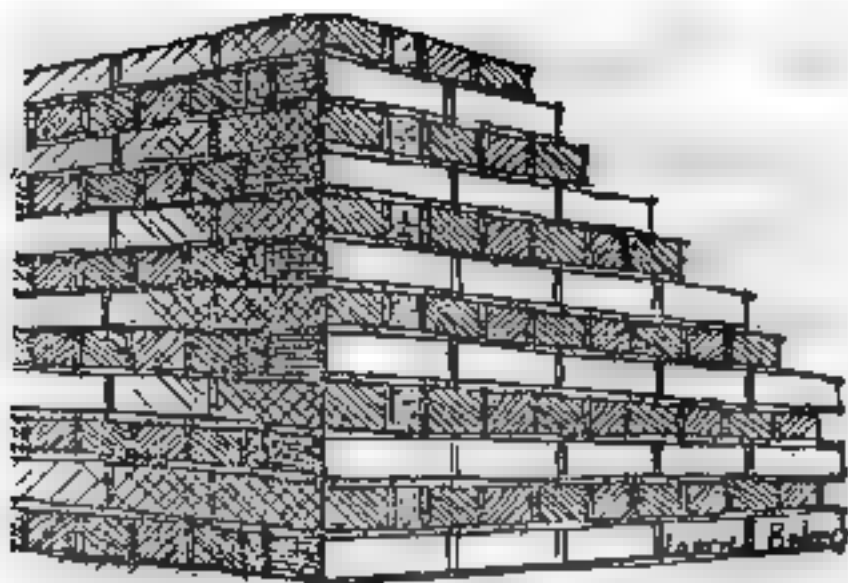


# BRICKWORK

The ENGLISH BOND

was the most commonly used 9" brick wall in India. It consists of alternate rows of 'headers' and 'stretchers'.

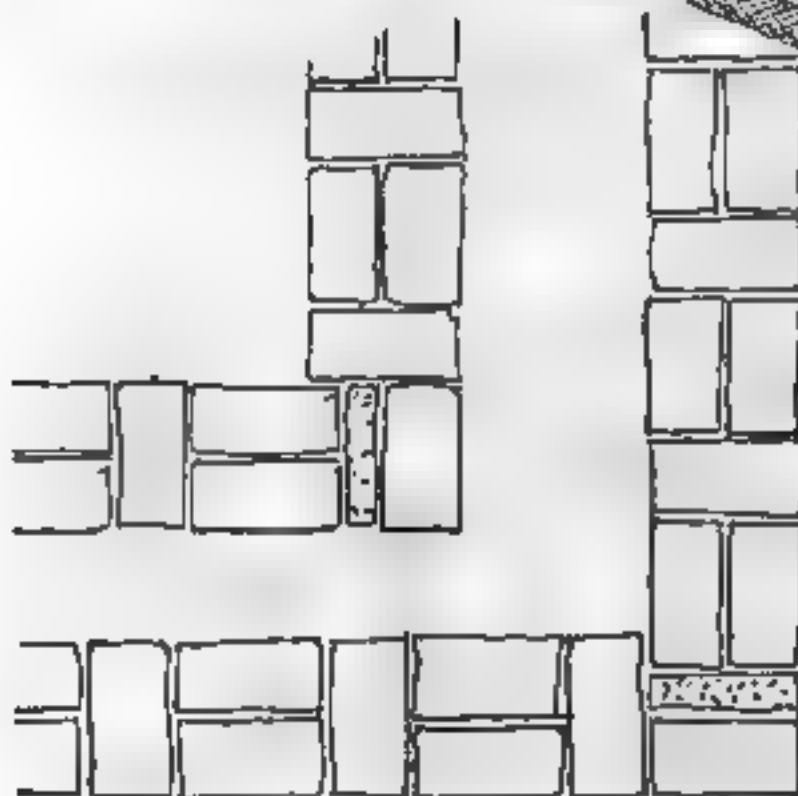
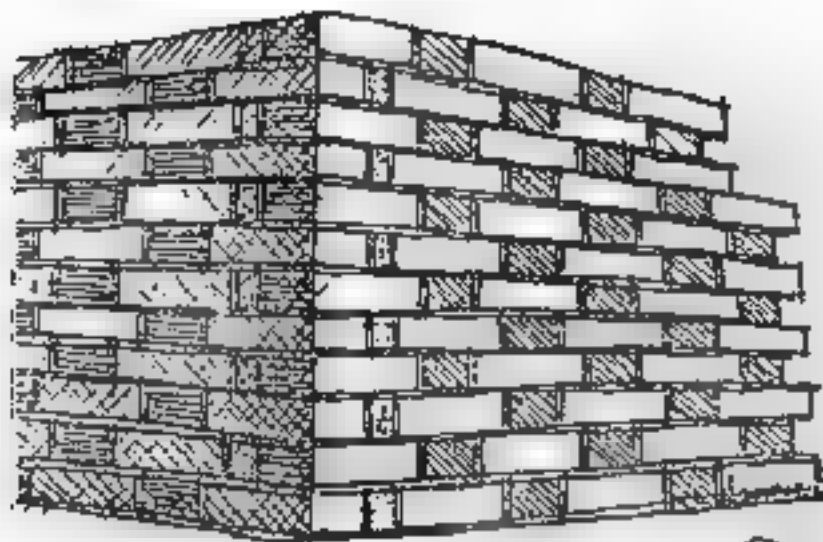




## The FLEMISH BOND

places bricks alternating  
a header, a stretcher, a header  
& so on. It has a few mild  
advantages over the English  
Bond, but is still not  
commonly used.

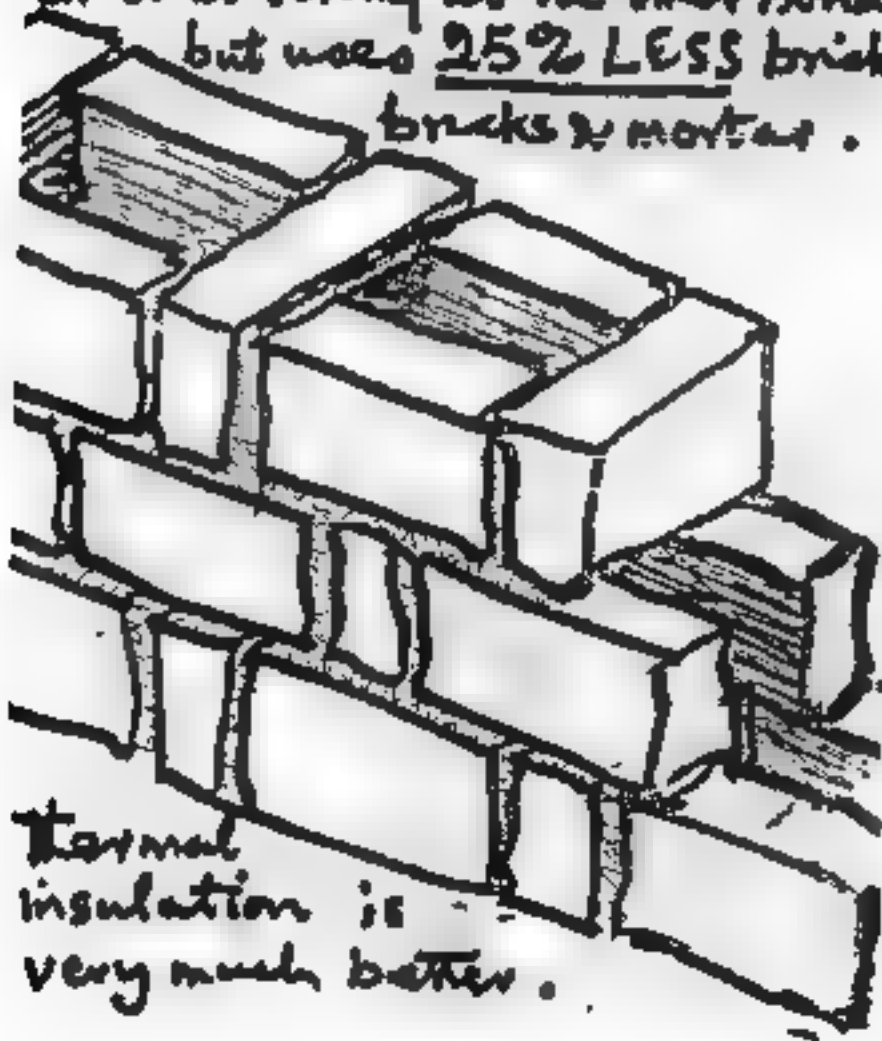


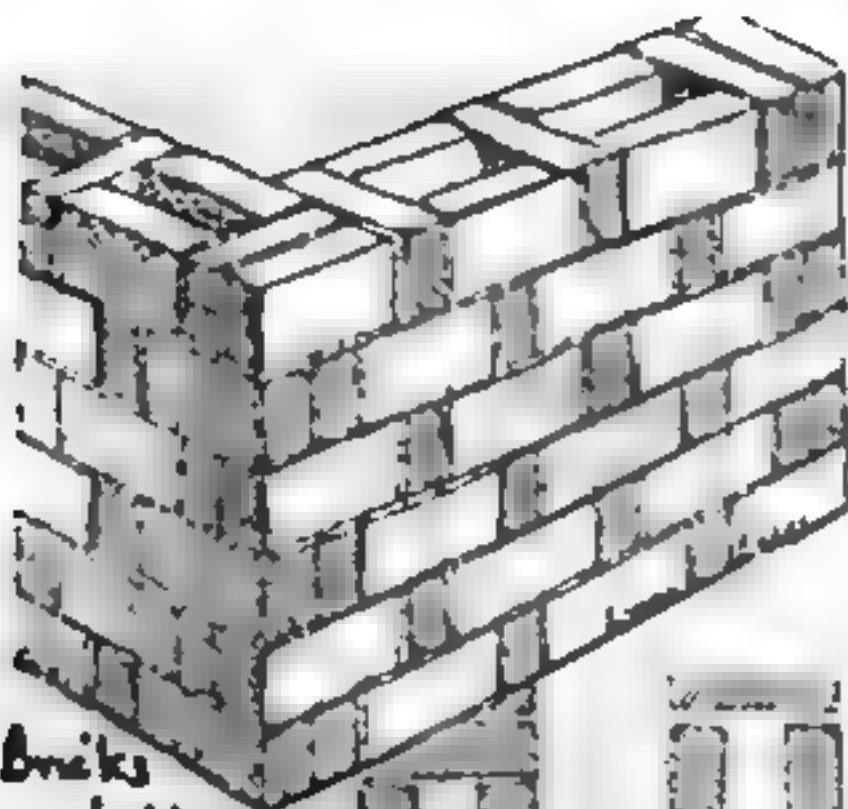




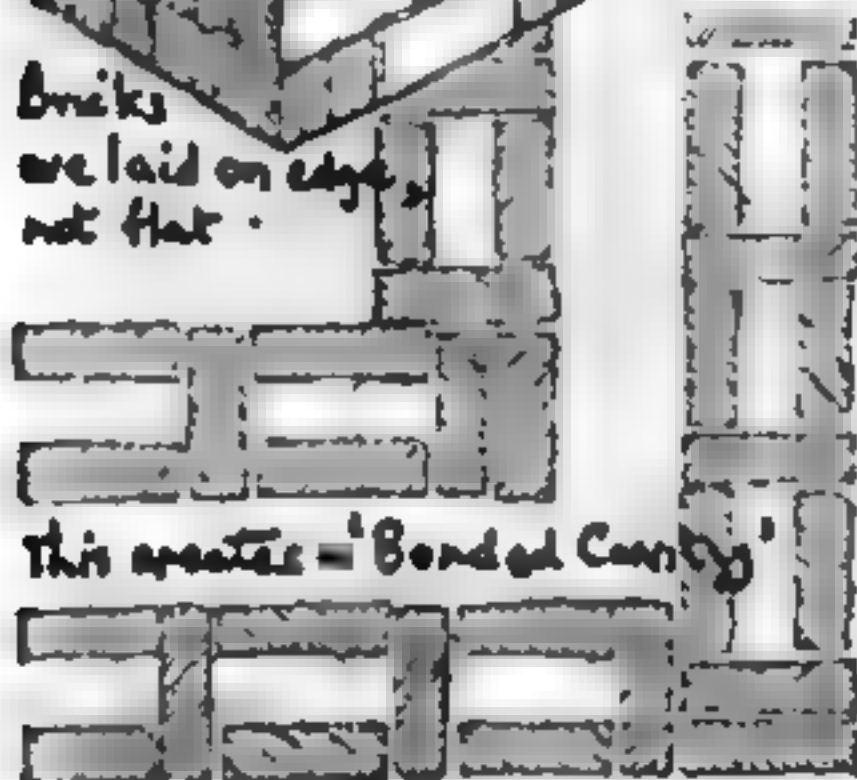
## The RAT-TRAP BOND

is still mainly unknown in India, tho used in England for the past several hundred years. It is as strong as the other bonds but uses 25% LESS bricks & mortar.





Bricks  
are laid on edge,  
not flat.



This creates - 'Bonded Cavity'

# RAT TRAP BOND



The CAVITY in the RAT TRAP BOND wall ensures good insulation from heat or cold.

This can be ruined by a poor mason carelessly slopping mortar into the cavity while he is building.

To avoid this

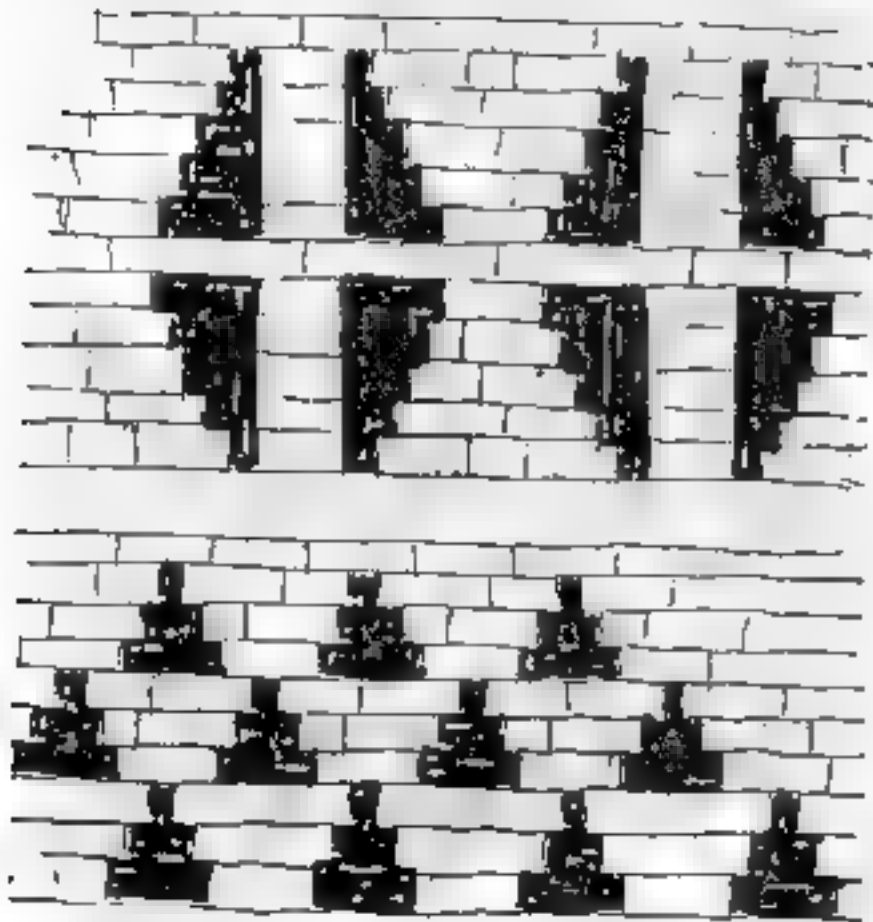
1. Make sure the mortar is not too wet, and
2. use a 3" wide strip of wood, laid over the central cavity & place the mortar on both sides of it.

(No mortar is required on the middle of the cross brick)



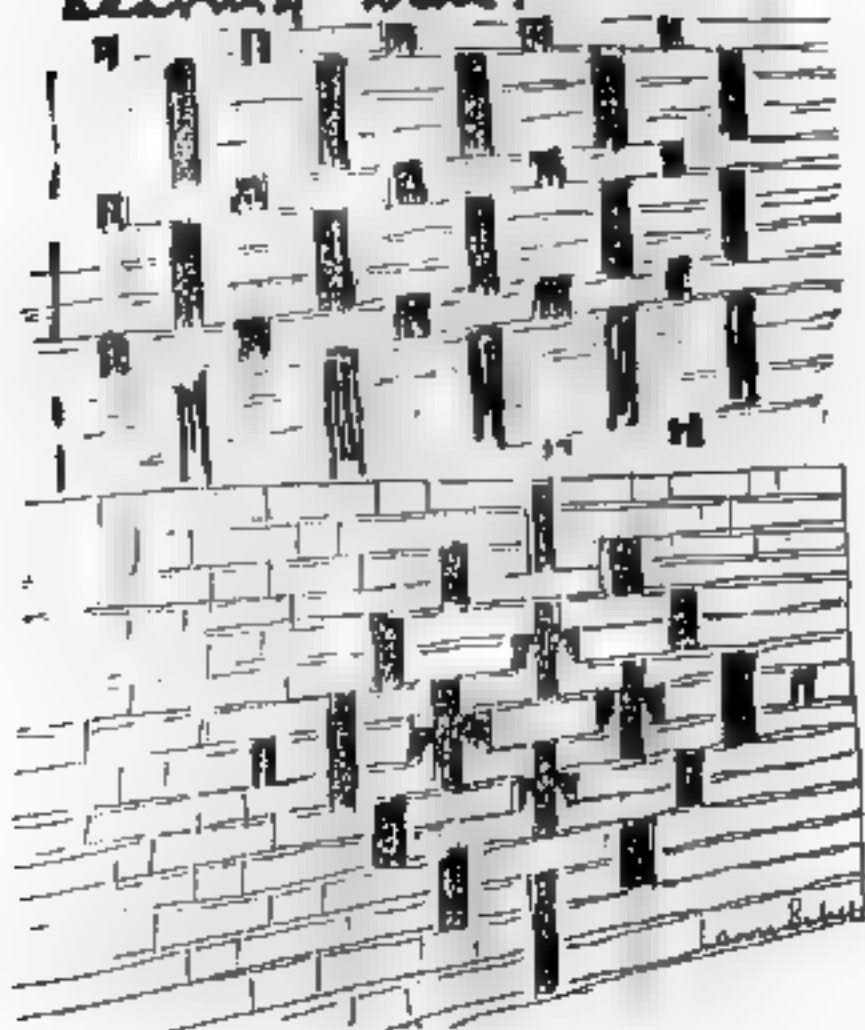
# BRICK JALI

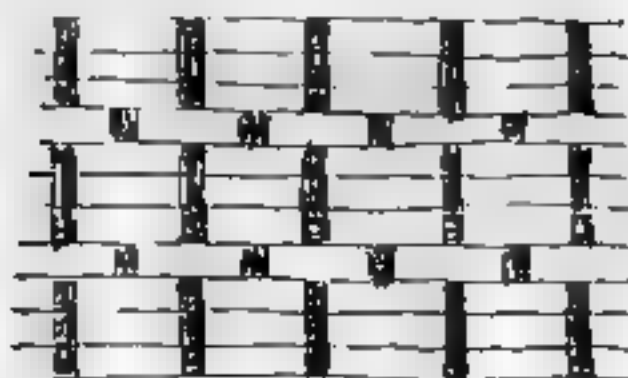
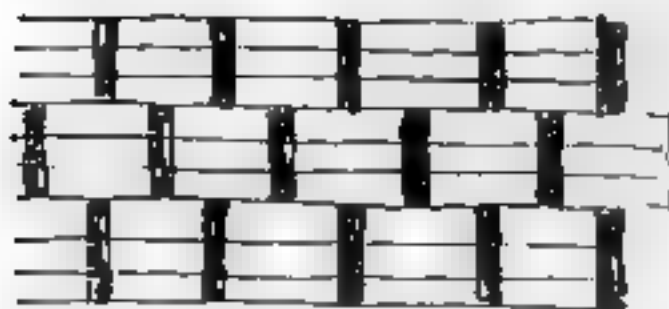
'Jali' - formerly pierced stone panels - is one of India's oldest methods of letting into a building filtered light & ventilation but maintaining privacy & security



# BRICK JALI

can function in the same way - either as panels or as a complete load bearing wall.





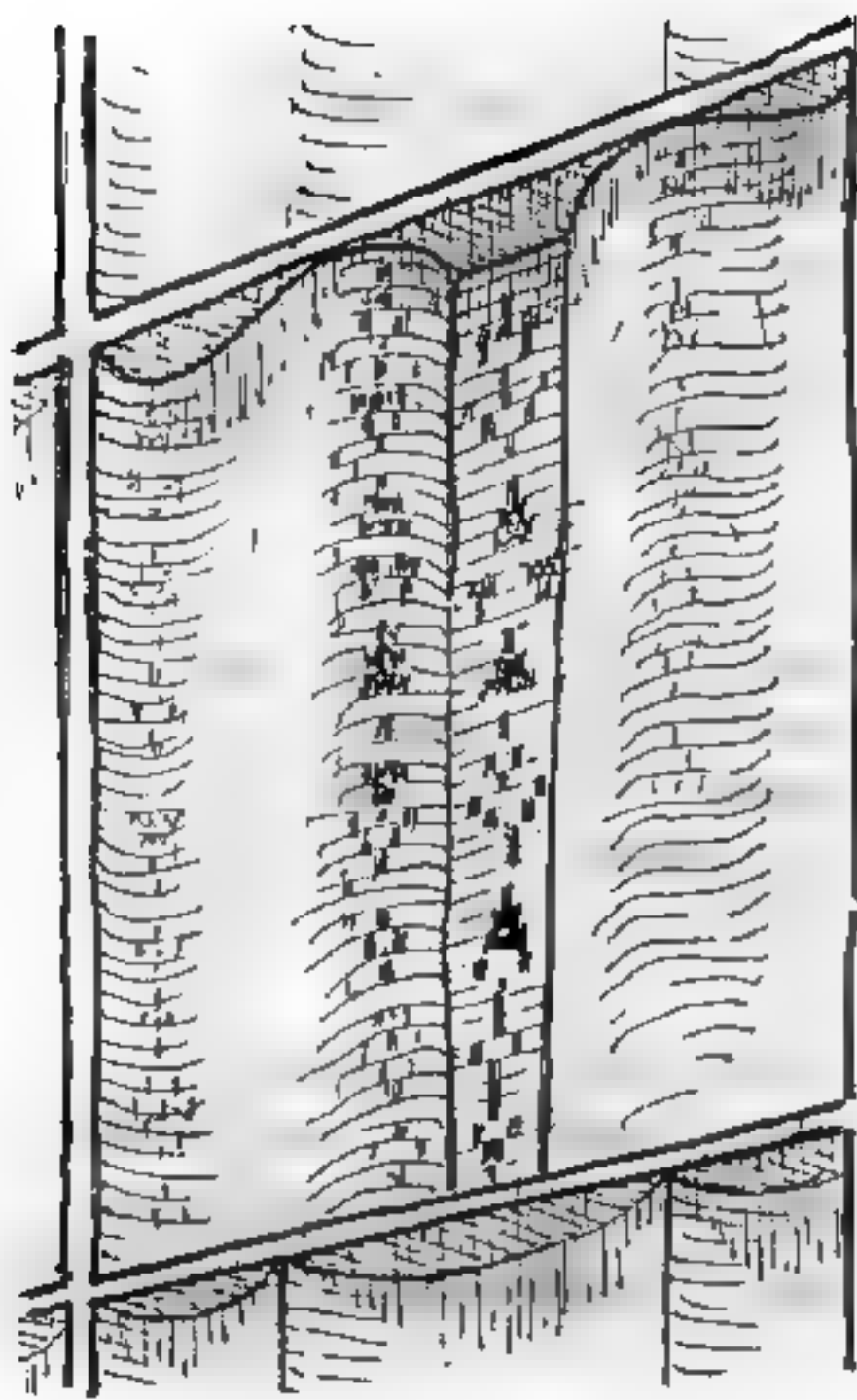
There is the old  
"Honey Comb" pattern of  
'jali' brick work

The holes can be  
extended vertically

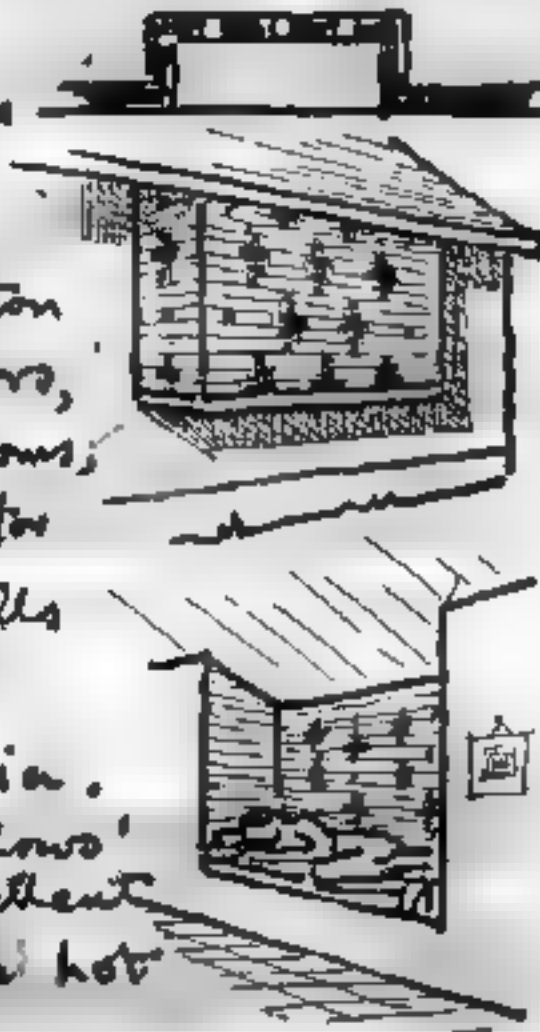
or there can be  
alternating sections of  
one row of holes  
followed by 2 or 3 rows  
of holes, then the single  
hole row again - & so on.  
:

Once these patterns have  
been used - a good mason  
can devise & enjoy doing  
many patterns.

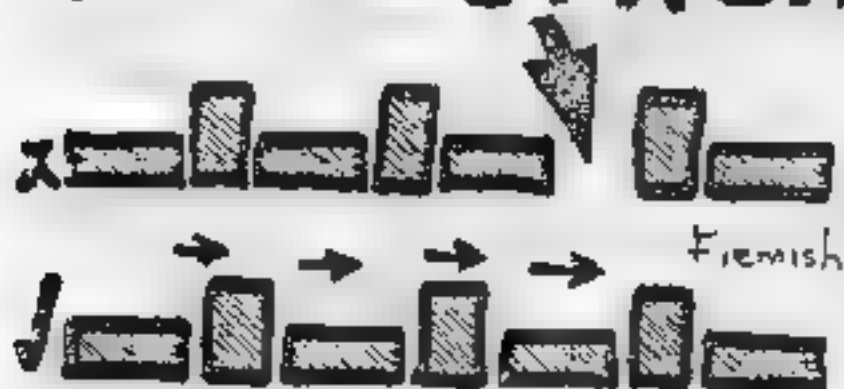




Floor to ceiling, & column  
 to column, large panels of  
 jali can be 'corrugated'  
 or 'folded' (for strength -  
 & even for  $4\frac{1}{2}$  inch brick walls)  
 & give  
 first class  
 lighting  
 and  
 ventilation  
 to corridors,  
 class rooms,  
 & even for  
 large halls  
 and  
 auditoria.  
 Bay 'windows'  
 make excellent  
 beds in the hot  
 weather.

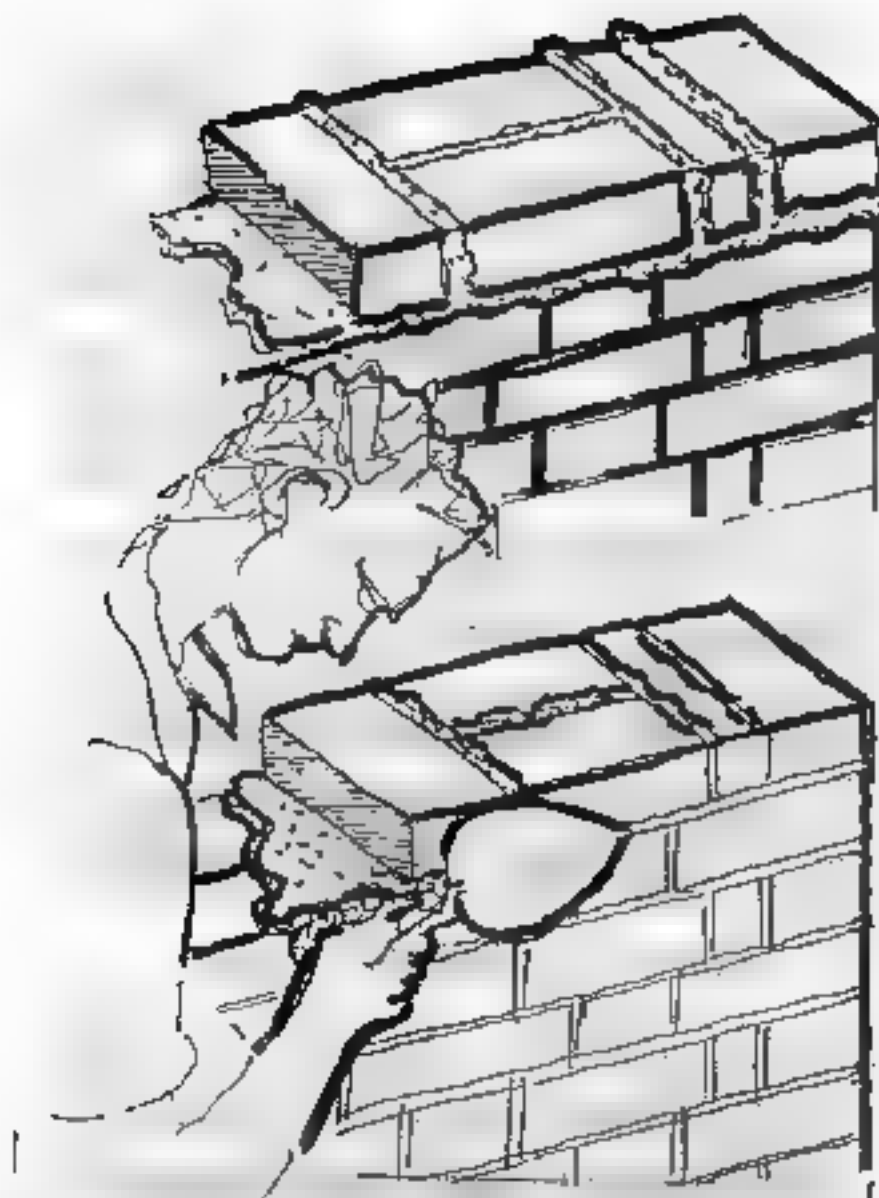


# BRICK SPACING

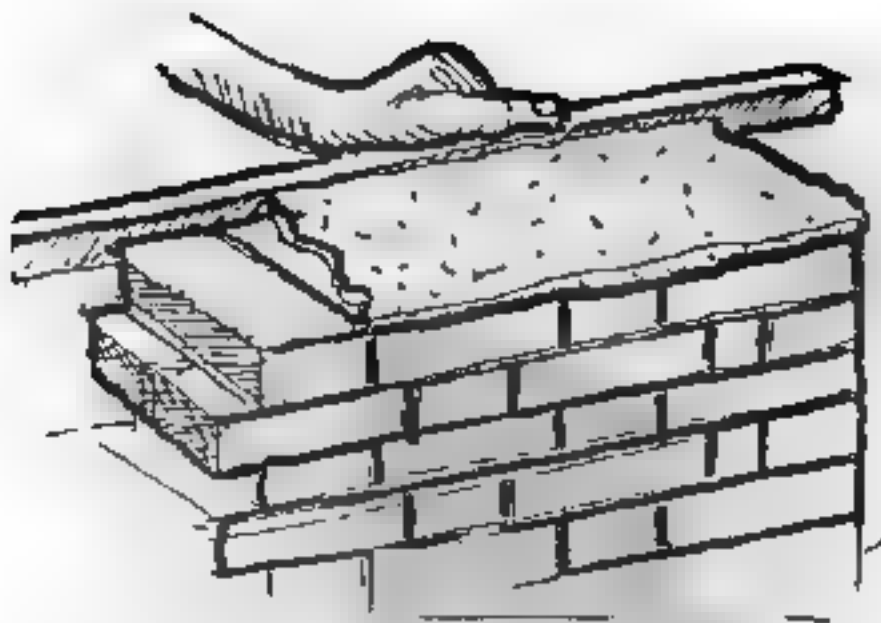


When LAYING OUT  
a brick wall of a specific  
length, always first lay out  
one row of bricks. This may  
leave a small gap, or  
over-run the end of the wall.  
DO NOT INSERT A  
SMALL PIECE - by  
doing so you will create  
bonding problems up the  
whole height of the wall.

Just by moving each  
brick a tiny fraction - you  
can make the right number  
of bricks fit correctly  
into the length of the wall  
required.



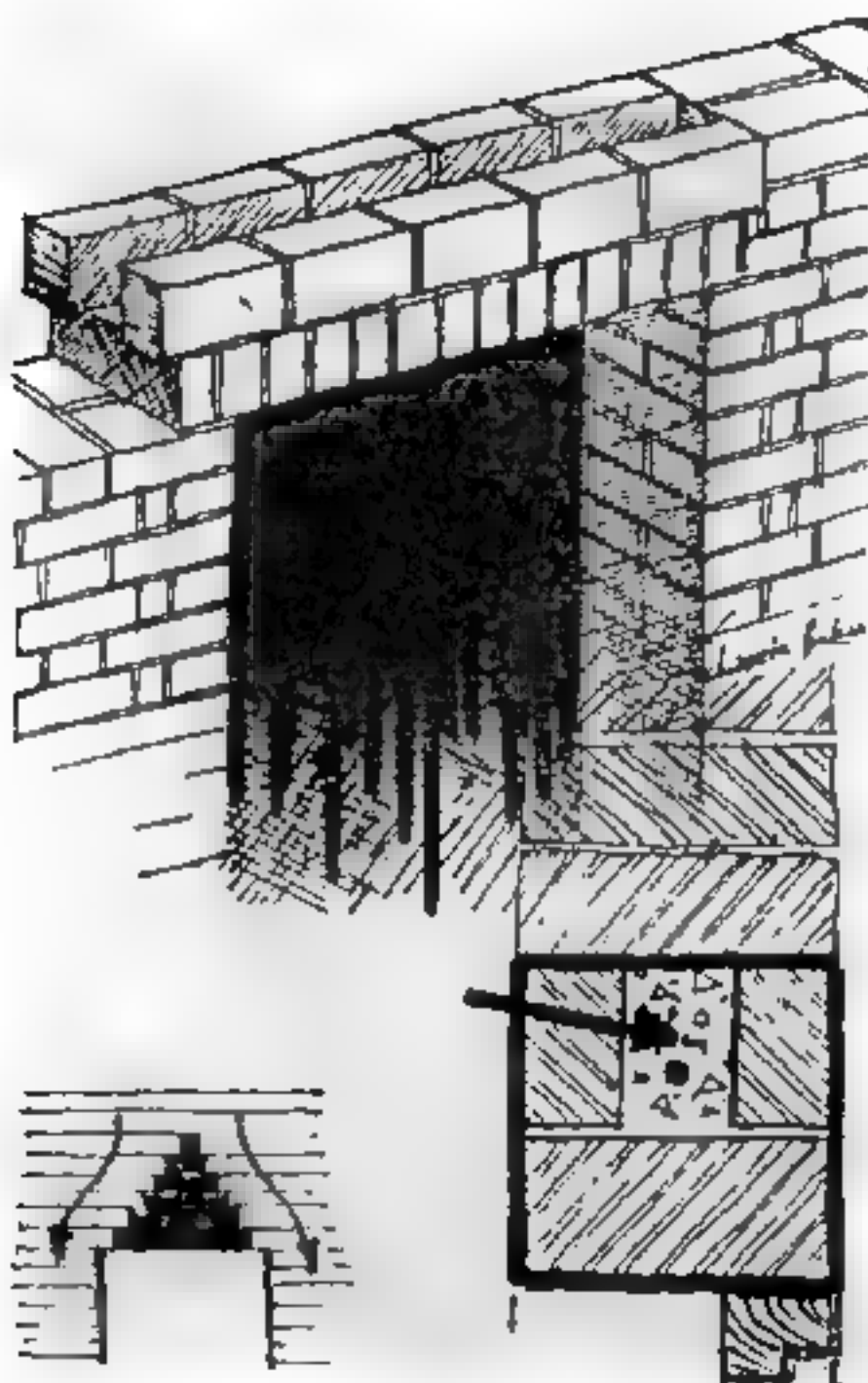
This way of pointing  
should be done as the work  
proceeds - NOT as an 'extra'.



## POINTING

Gives a smooth finish to an unplastered wall & is usually done as an extra job after the wall construction is complete.

Much less costly is to lay the mortar, place on it the bricks, give a mild blow with your fist to the brick & then press in the bulging mortar with your trowel.

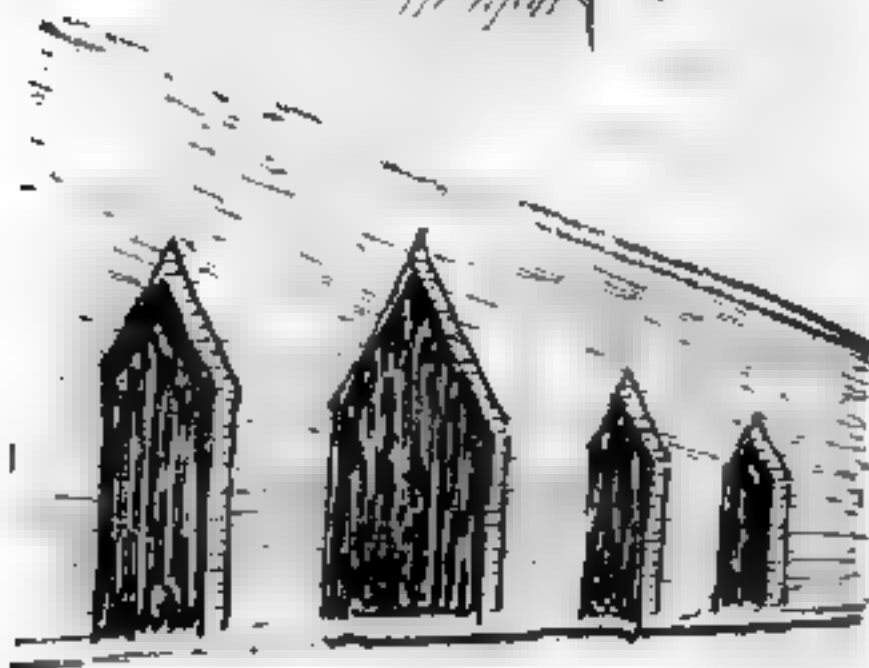
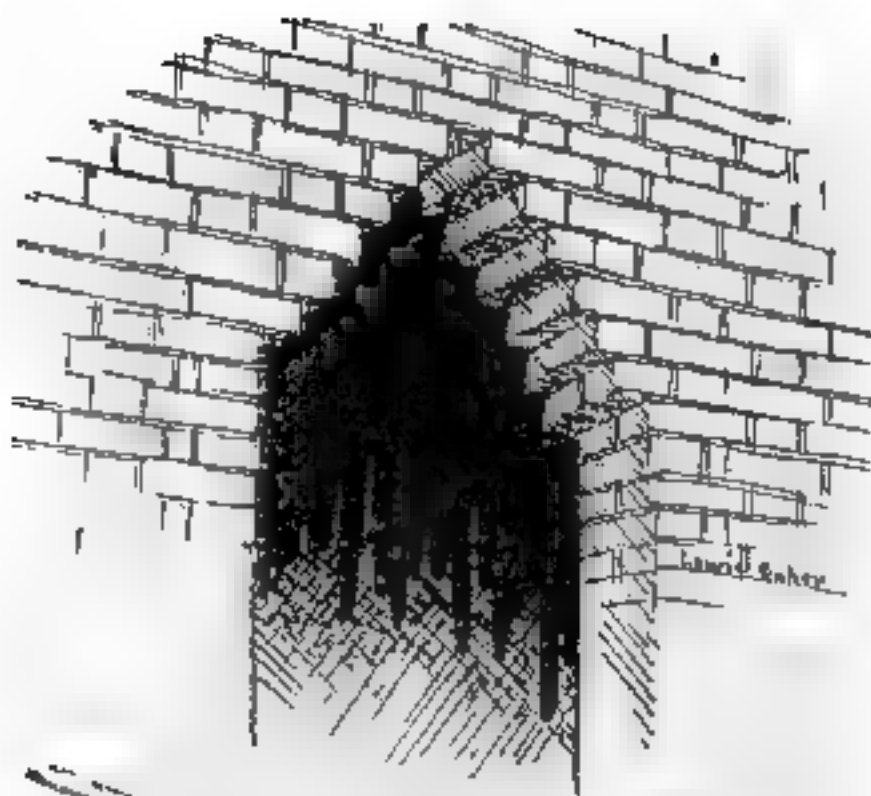


# LINTELS

A lot of unnecessary steel and cement concrete is used for lintels.

Instead, place one row of bricks on edge over the frame (or space) & then above them, one on each side, a row of more bricks on edge. The space between these upper two rows of bricks is then filled with concrete in which a small steel rod is placed. The only weight the lintel is actually carrying is a small triangle of brickwork. All other weights of walls from the above are carried by the wall at its sides of the opening.





# CORBEL ARCH

The usual round & segmental arches need shuttering or support during construction.

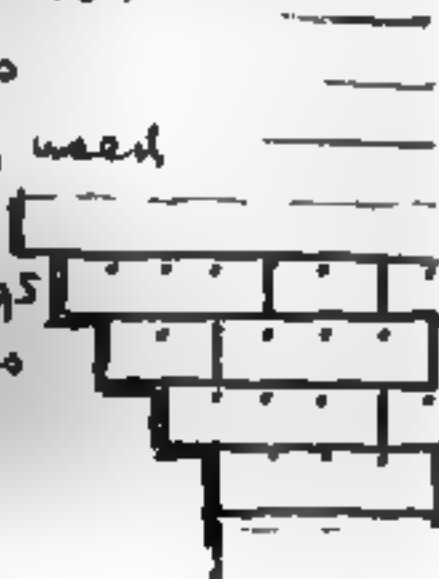
The Corbel arch needs no support & is extremely simple & easy to make.

One quarter of a brick is extended out from the brick below it.

The writer has

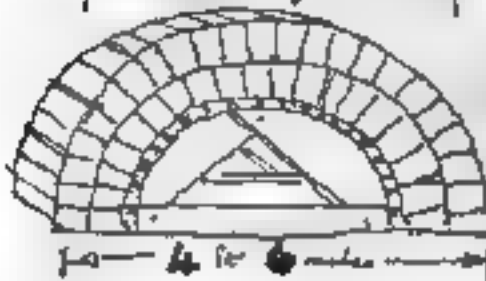
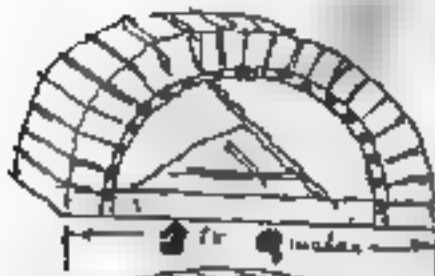
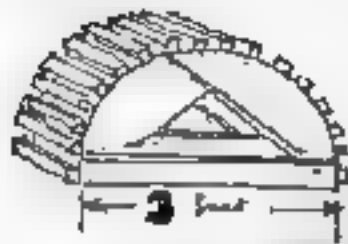
Successfully used

such arches  
over openings  
up to 5 metres  
wide.





# ARCHES



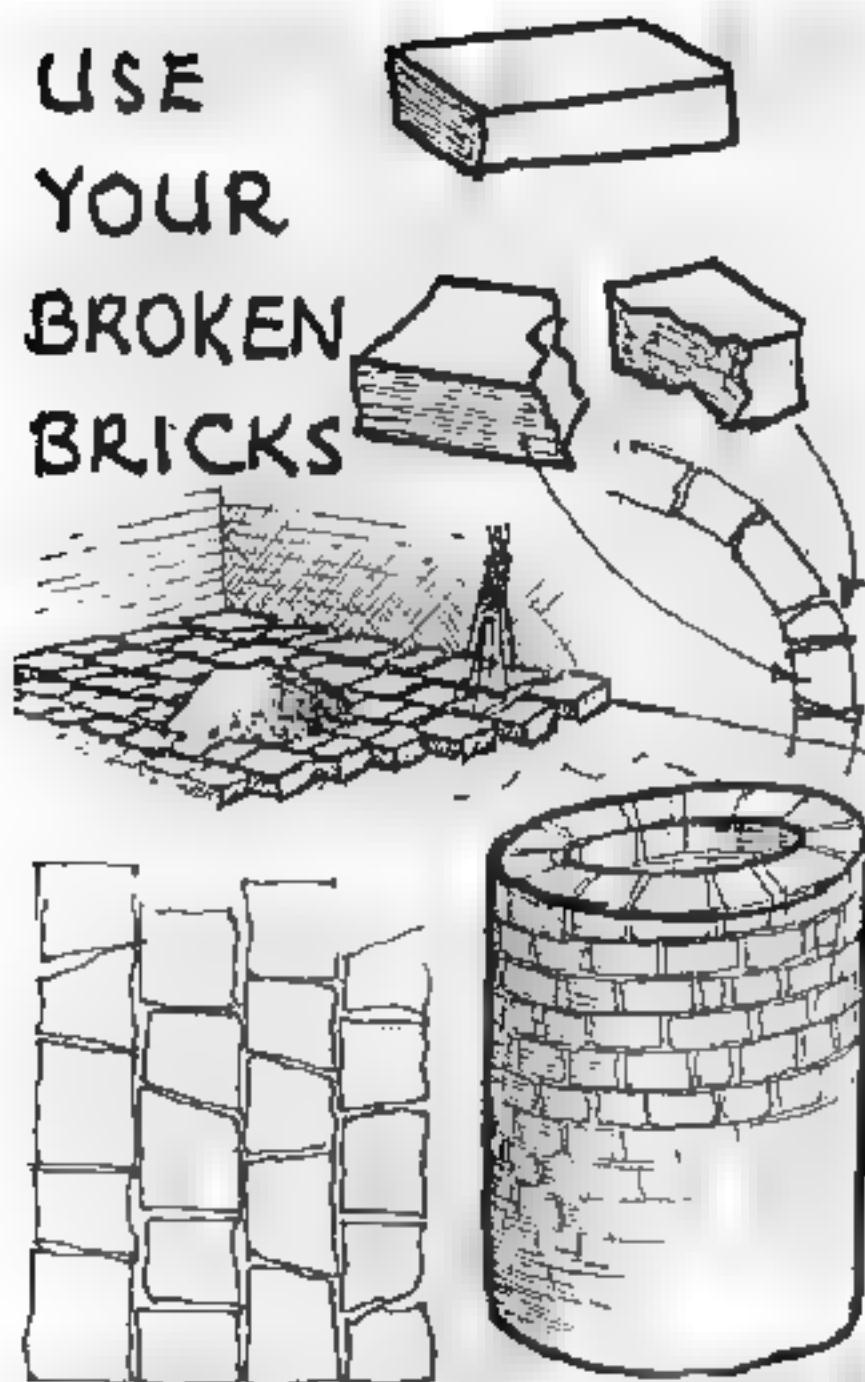
Can be of different shapes & sizes & are much less costly than R.C. lintels.

But while constructing them, some sort of framework

or support is necessary.

In one building there may be arches of different sizes so make one frame for the smallest — & add a row or 2 of dry bricks (no mortar) for the larger arches.

USE  
YOUR  
BROKEN  
BRICKS



## BROKEN BRICK PIECES

On most sites where brick is being used, there are plenty of broken pieces lying on the ground.

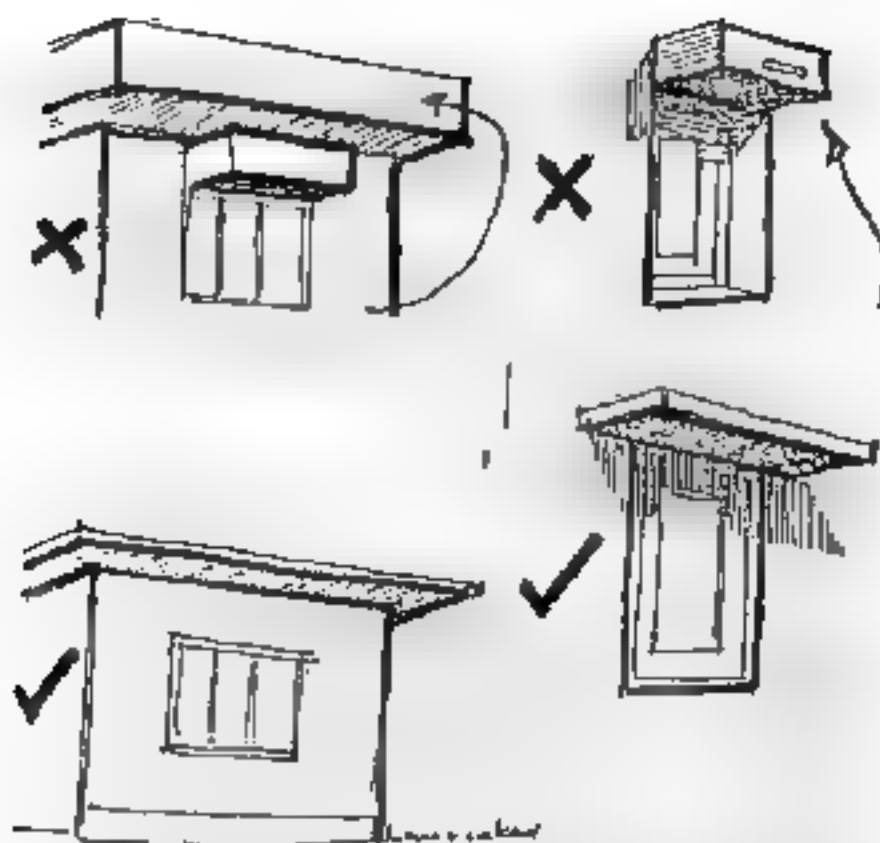
### USE THEM !

Beat hard & level your earth infilling 'floor'.

Lay the broken bricks close together. Mix on top a weak lime mortar & brush it in & you have an excellent base for tile or plaster flooring.

### For LEECH PITS

(see elsewhere) lay the broken pieces in a circle with DRY joints. Then a layer of horizontal mortar - & another layer.

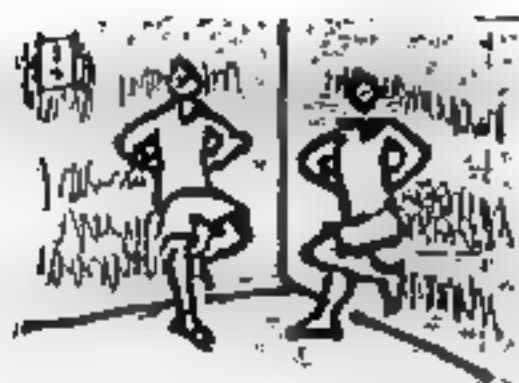


## FANCY SUNSHADES

Serve no purpose except to  
collect leaves.

They are unnecessary &  
costly—so

## DONT USE THEM



## DONT USE PLASTER

unless it is really necessary.  
Put it all over a building & it  
accounts for about 10% of the  
Total cost!

Fungus grows on it outside.  
People finger it, & lean on it,  
inside. It either looks  
dirty & ugly or you have to  
re-paint it every year at  
considerable cost.

There are a few places where it is  
useful - kitchen, bathroom,  
but elsewhere, neat brick work  
looks better.



# MORTARS AND

CEMENT & SAND  
1 PART                      8 PARTS

Use Cement only if nothing else is available. It is an 'energy-intensive' material

LIME & SAND  
1 PART                      3 PARTS

Good for all types of brick & stone work. (The setting time is slower than cement).

LIME, CEMENT & SAND  
1 PART      4 PARTS      14 PARTS  
This sets almost as quickly as cement

# PLASTERS

LIME & SURKI & SAND  
1 PART. 2 PARTS 6 PARTS

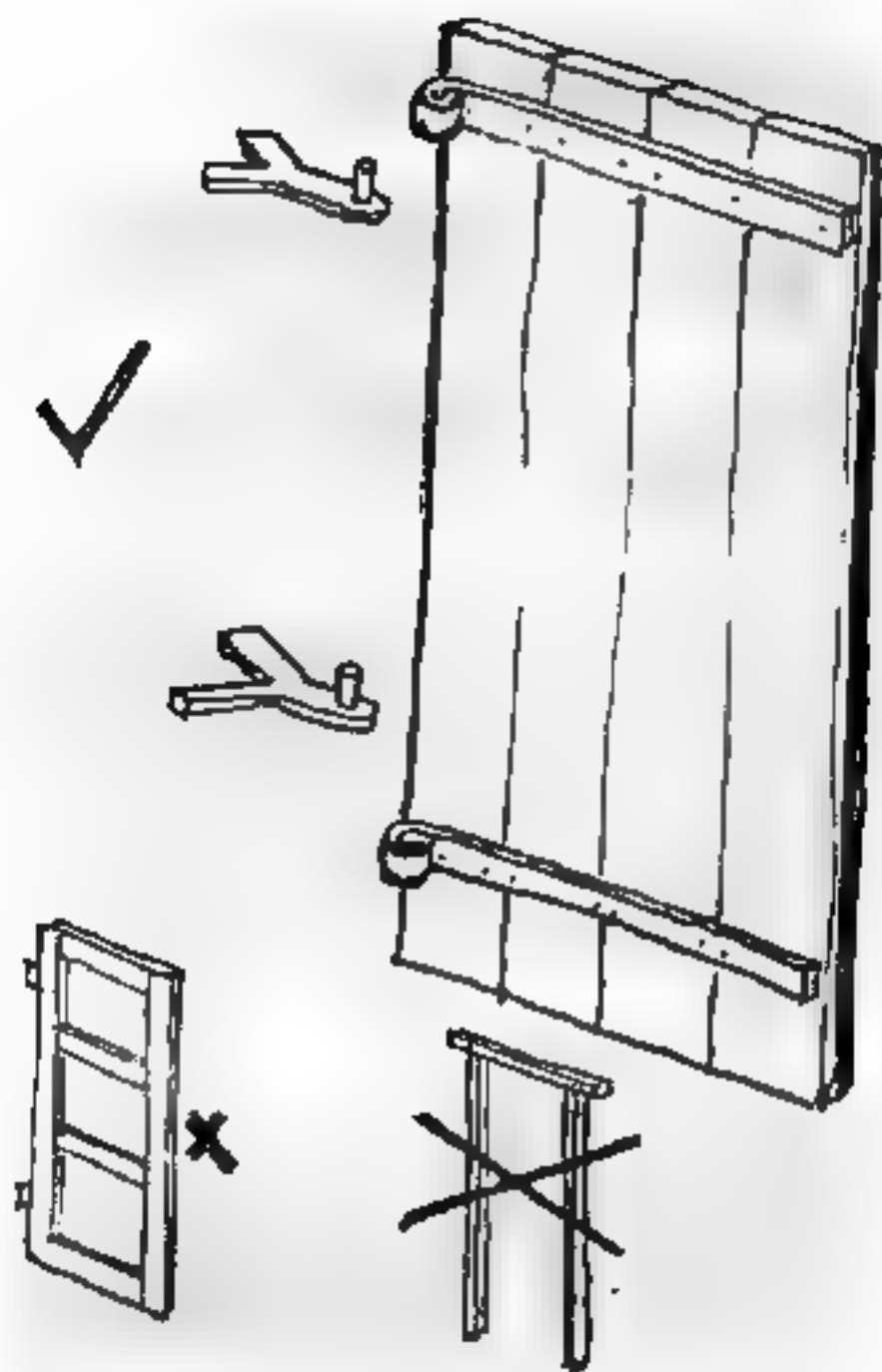
This is a little stronger than  
lime alone & sets more  
quickly.

LIME, SURKI, CEMENT & SAND  
1 PART. 2 PARTS 4 PARTS 20 PARTS

This sets almost as quickly as  
Cement

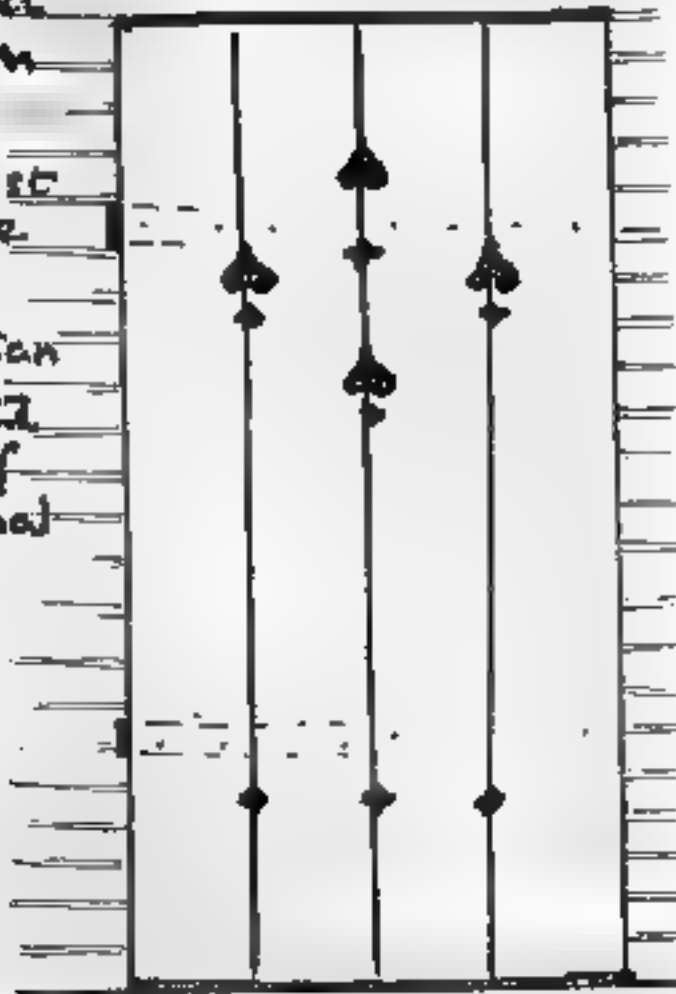
## MUD.

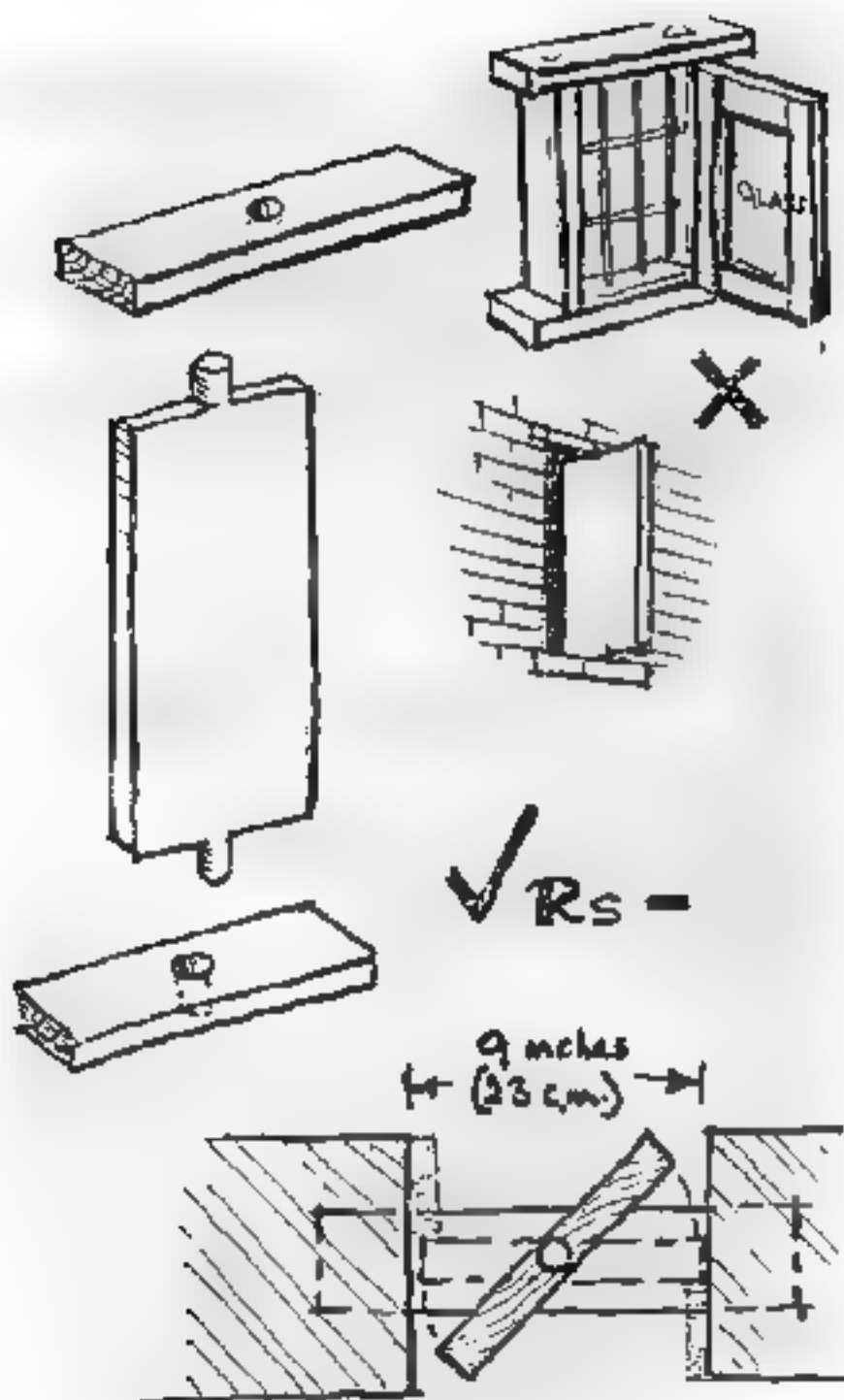
Use the same mud that mud  
blocks are made of. Sift it &  
mix it with only enough water  
to make it 'plastic' & workable.



**DOORS** do not have to have frames, panels etc. A few planks can be fixed together with strap hinges to form a strong door. A little bit of cutting can give a small pattern

The cost will be much less than half the cost of a normal door.

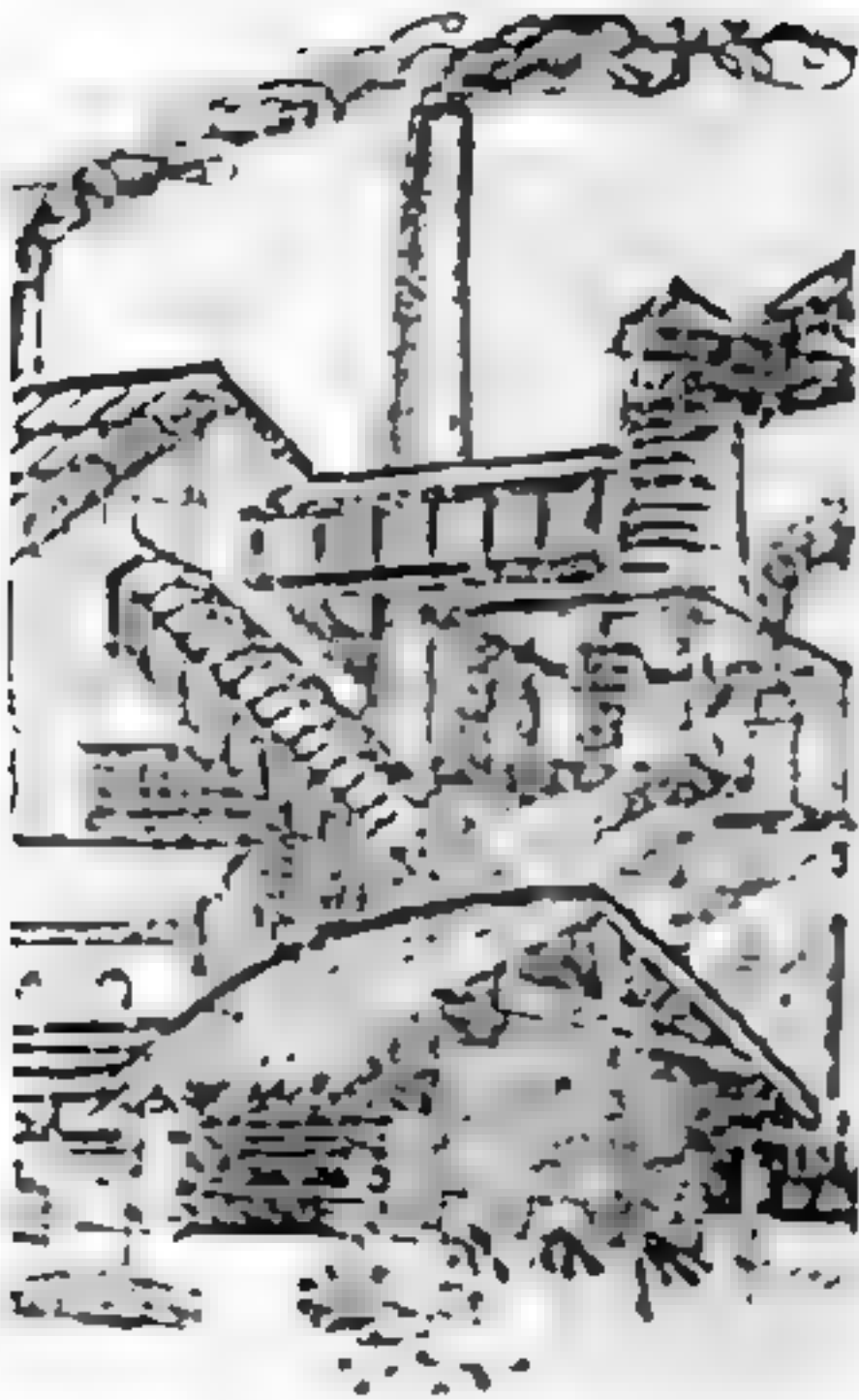




A WINDOW with a frame  
& a shutter, with glass,  
& perhaps a metal grill, is  
very costly.

A simple 1" thick,  
9" wide plank of wood,  
with a rounded protrusion  
at both ends, will fit  
into 2 strips of wood  
(30 or 35 cm long, 8 cm wide)  
- you have a 'window'!  
shutter costing only 20%  
of the normal window!  
Even when it is open, no  
one can climb thro the two  
4 inch openings, so no grill  
is required. If a larger window  
is needed, put 2 or 3 in a row.





# The production of CEMENT & STEEL

both use an enormous amount of ENERGY (fuel) and cause a lot of air pollution.

Also mountains of ugly useless waste material is dumped all round the factories.

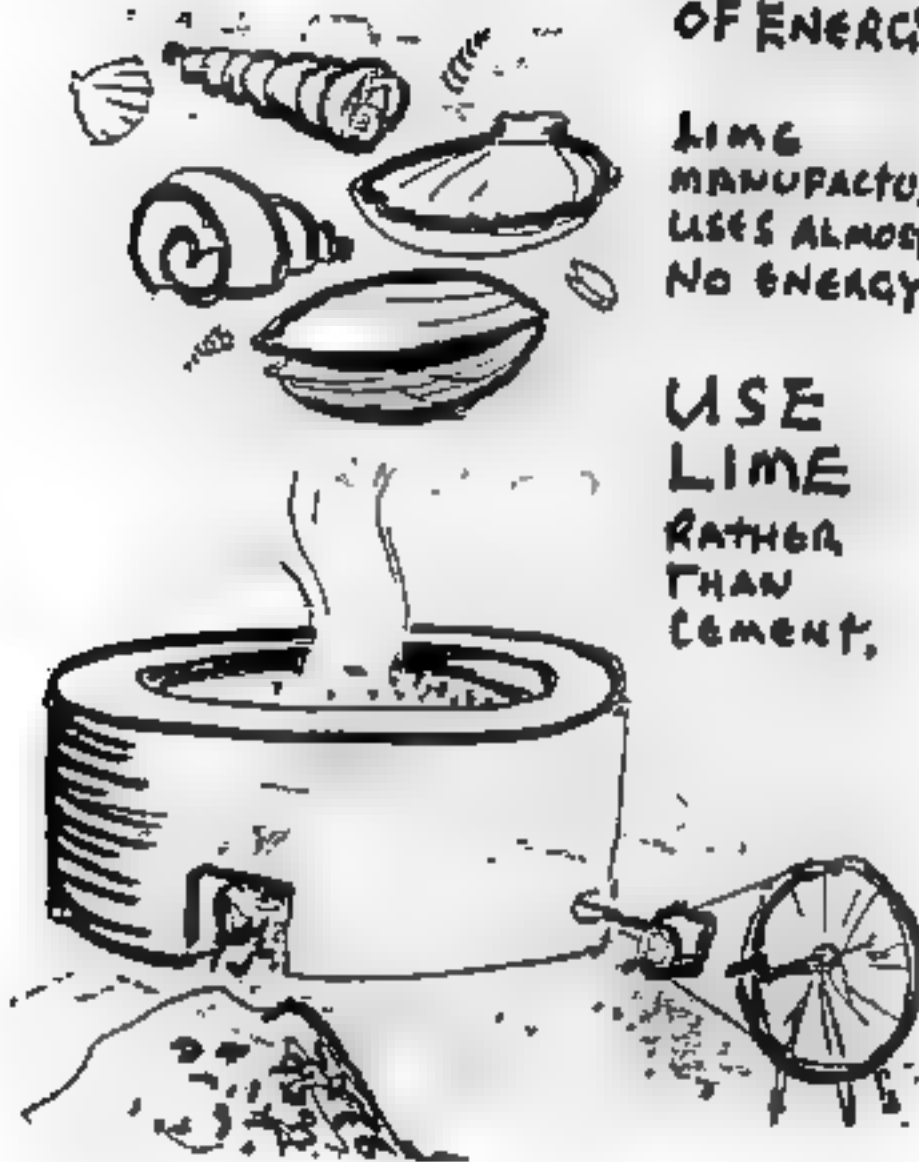
Production is costly and India is short of energy.



INDIA  
IS SHORT  
OF ENERGY.

LIME  
MANUFACTURE  
USES ALMOST  
NO ENERGY.

USE  
LIME  
RATHER  
THAN  
CEMENT.



# LIME

Cement & Lime are both made from the Calcium found in limestone & shells.

These can be burned in a mud kiln (only a handful of charcoal is needed to start the burning process) After burning & cooling sifting the remains gives you lime.

Cement is also made from the same ingredients, along with other items — & it uses a lot of fuel & processing.

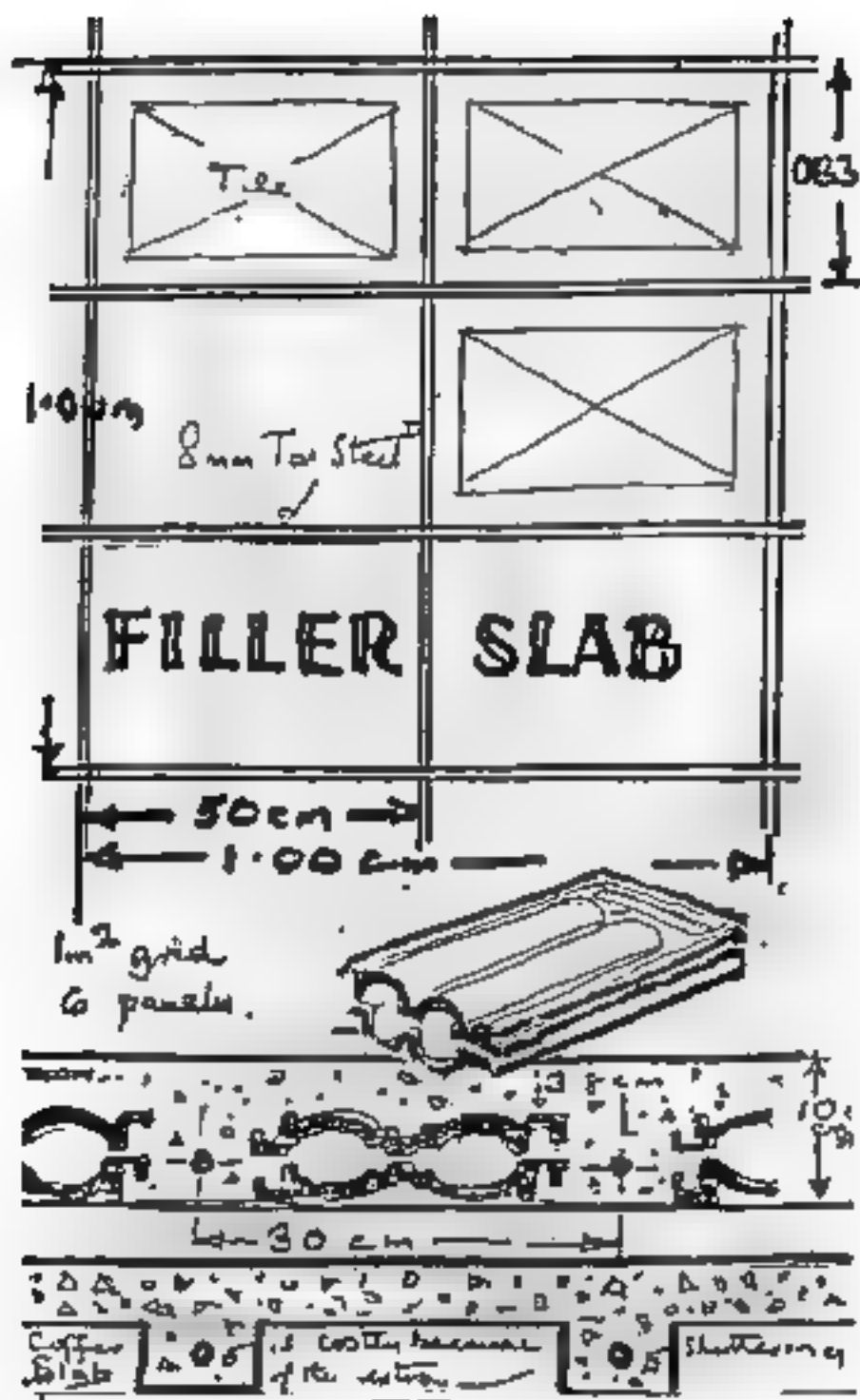
The ultimate strength, in mortar, plaster, concrete etc for lime & cement is the same.

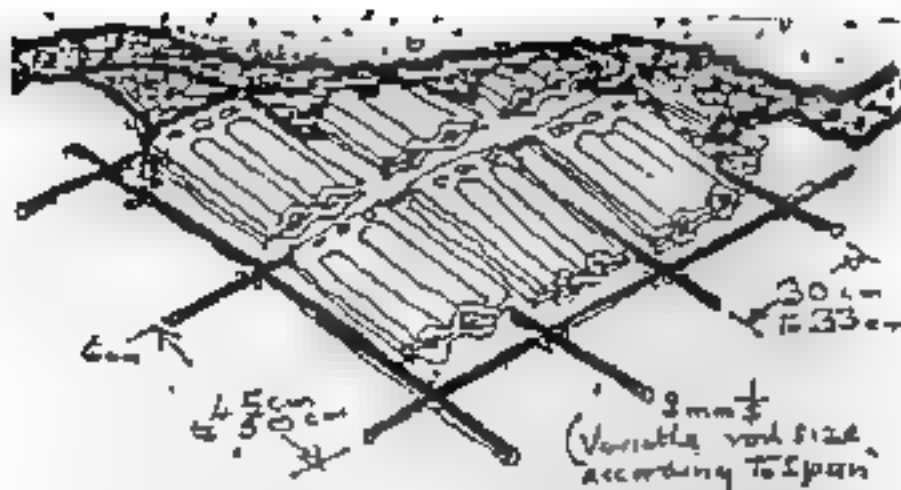
We denude our Forests  
to get building timber - but  
new trees can be  
planted for  
building  
purposes.



MOUNTAINS are DESTROYED  
To get iron ore & limestone  
for steel and cement.  
Once destroyed, the  
Mountains cannot  
be replaced.





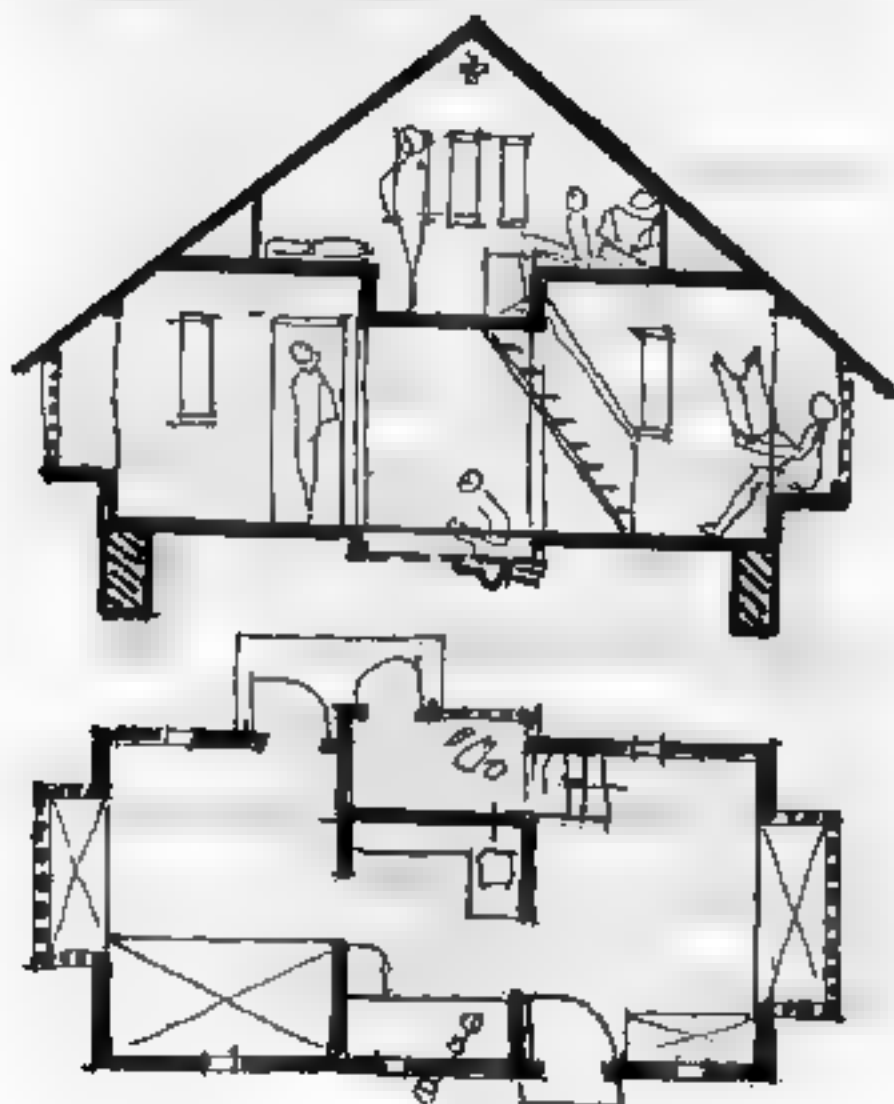


In the orthodox reinforced concrete slab the dead weight of the concrete is heavy. This weight can be lessened by putting light weight material between the steel rods.

The simplest 'filler' is to use two fifth grade Mangalore Tiles. These have no structural strength value — they are mere 'Fillers'.

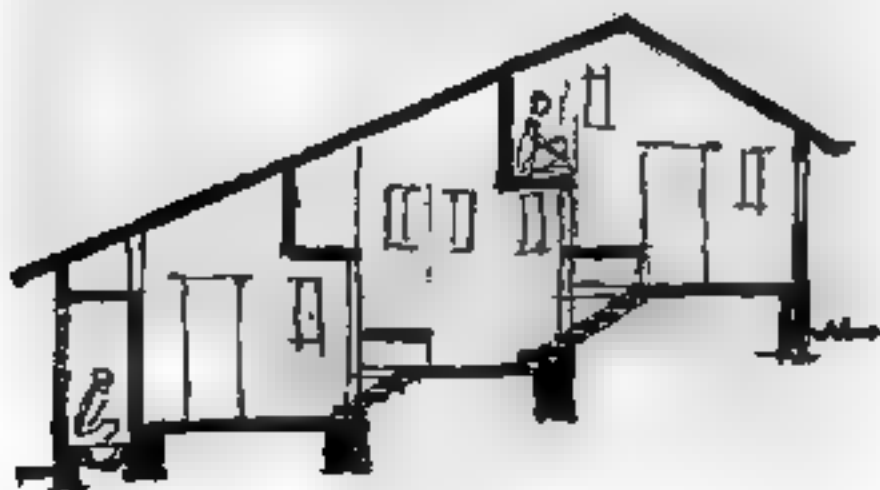
Using them saves about 30% dead weight of the 'slab' — so less steel is needed — so much Steel, Sand, Cement, Metal & Cost is saved.

These sections show how  
the 'living space' is increased  
without enlarging the total  
floor area of a small house.



# LOFTS & BUNKS

When a sloping roof is asked for (or a sloping site makes a sloping roof more economical) there is usually quite a lot of "spare space" under the lower sloping parts & these can be used not only for shelves & storage but also for seats & beds.







# LATRINES

Whenever the need for housing schemes comes up, inevitably eventually the subject of latrine surfaces. Almost invariably, for community housing, someone suggests 'Group Latrines'. This idea has rarely, if ever, been successful & there is every reason why all new houses should have their own latrine.

The old Septic Tank system is still good (if built properly) but is comparatively very costly. A few other systems & problems are discussed now.

The Elderly,

Most

Women,

and children,

Do NOT like going down the garden  
during the  
night.

So Put

Your latrine  
in the  
house -

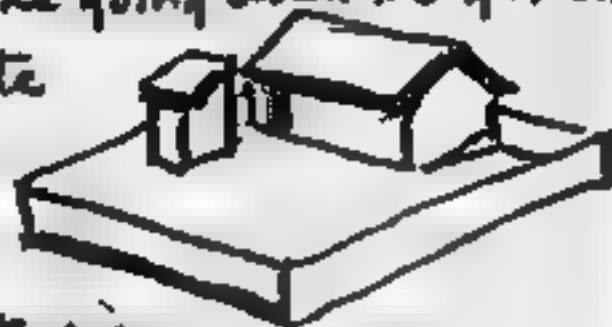
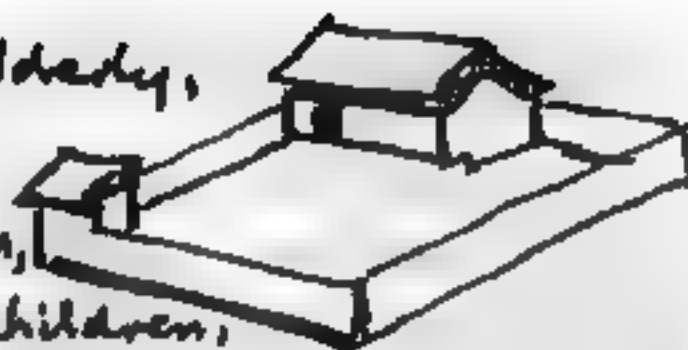
BUT

See That

it IS

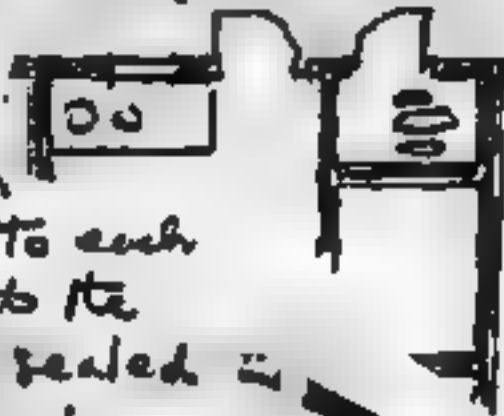
sealed

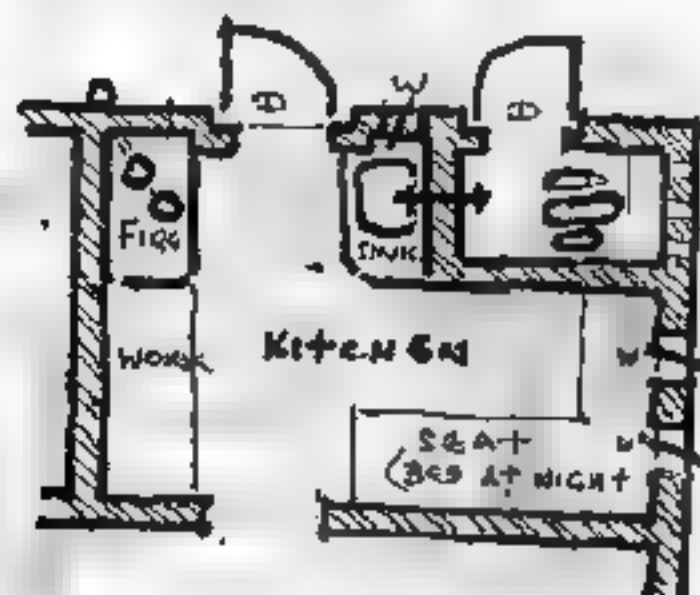
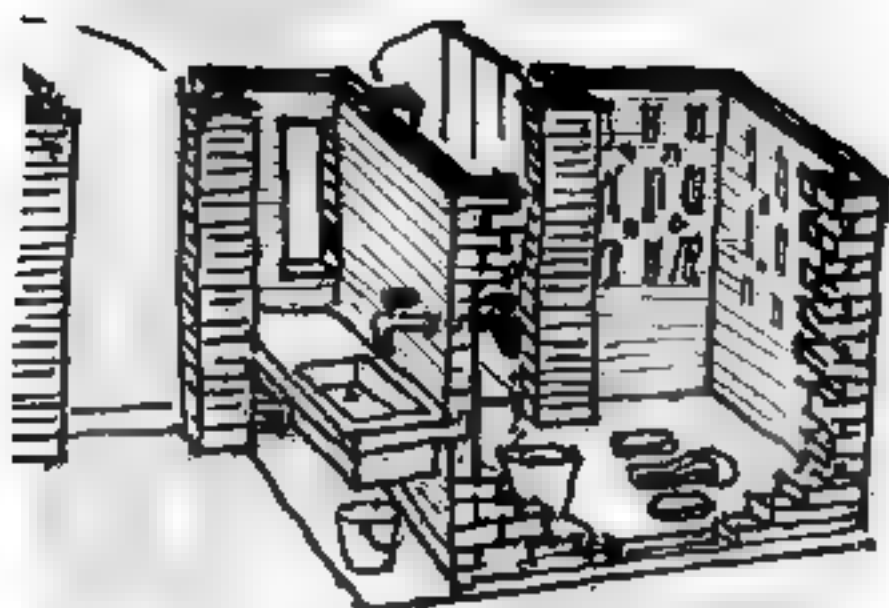
off from the rest of the house.



This latrine  
down the garden  
costs a lot  
more than one  
incorporated  
in the main  
house structure.

Kitchen  
& latrine  
doors can  
be close to each  
other but the  
latrine is sealed  
off & has no  
connection  
with  
the house  
interior.





Many families do not like to have the latrine under the house roof. Such prejudices can be removed if the lavatory is sealed off from the rest of the house (both walls & roof). Water piping is almost eliminated with a bath tap on one side of the wall & a Sink Tap on the other.

A wide built in seat in the Kitchen can act as an extra bed at night.

A smokeless chula can be near the door

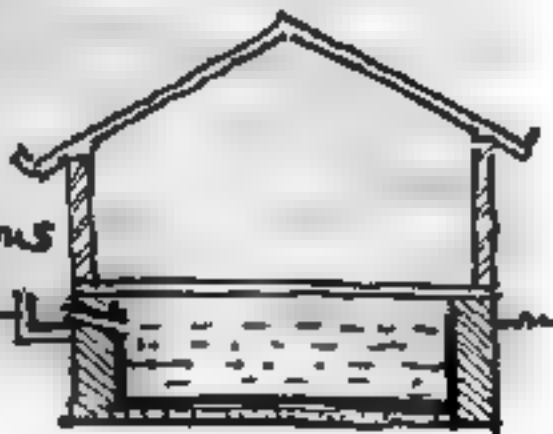


# RAIN WATER HARVESTING

is currently much talked about & desirable. However there must be suitable places to store the 'harvest' ! We also have to avoid evaporation.

One such place is the space between foundation & ground floor - but such a floor will be costly, as also the waterproofing of base & plinth walls.

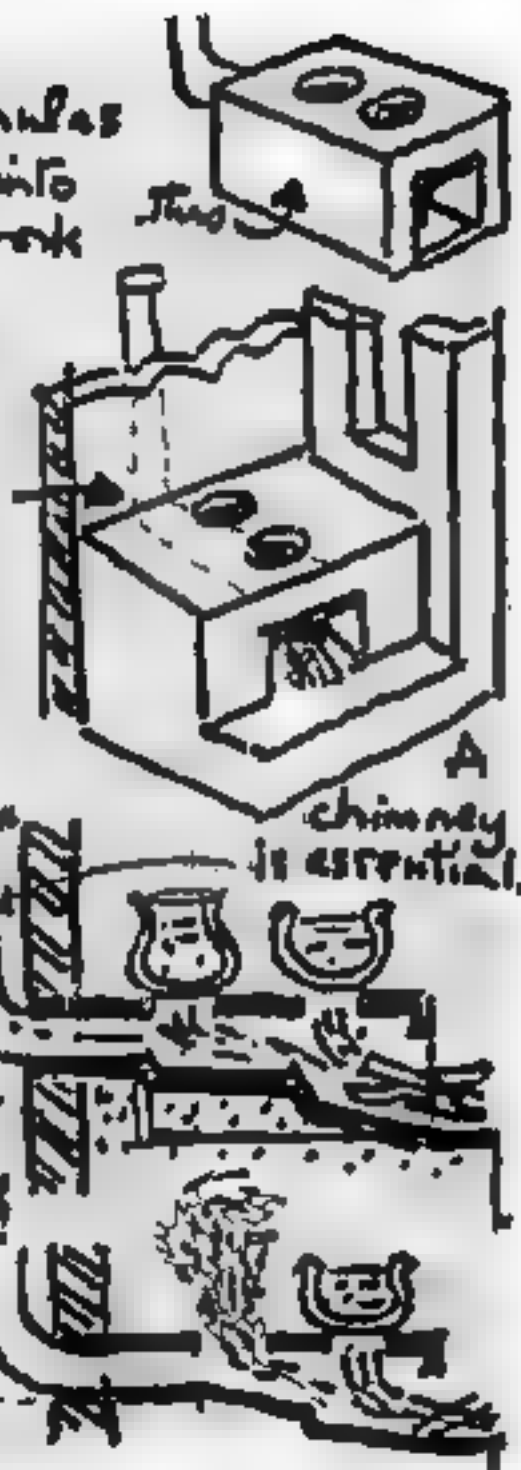
The system would be better if we had continuous rain !





Burnt Clay Chulas  
 can be built into  
 the kitchen work  
 'table'. If  
 there are 2  
 holes, two  
 pots can be  
 used at the  
 same time.

If you are  
 only  
 using one <sup>small</sup> pot - then  
 put a pot  
 of water on  
 the back hole  
 or the chula  
 will NOT  
 be  
 Smokeless



# SMOKELESS CHULAS

Formerly most  
people did their  
cooking on the  
floor.



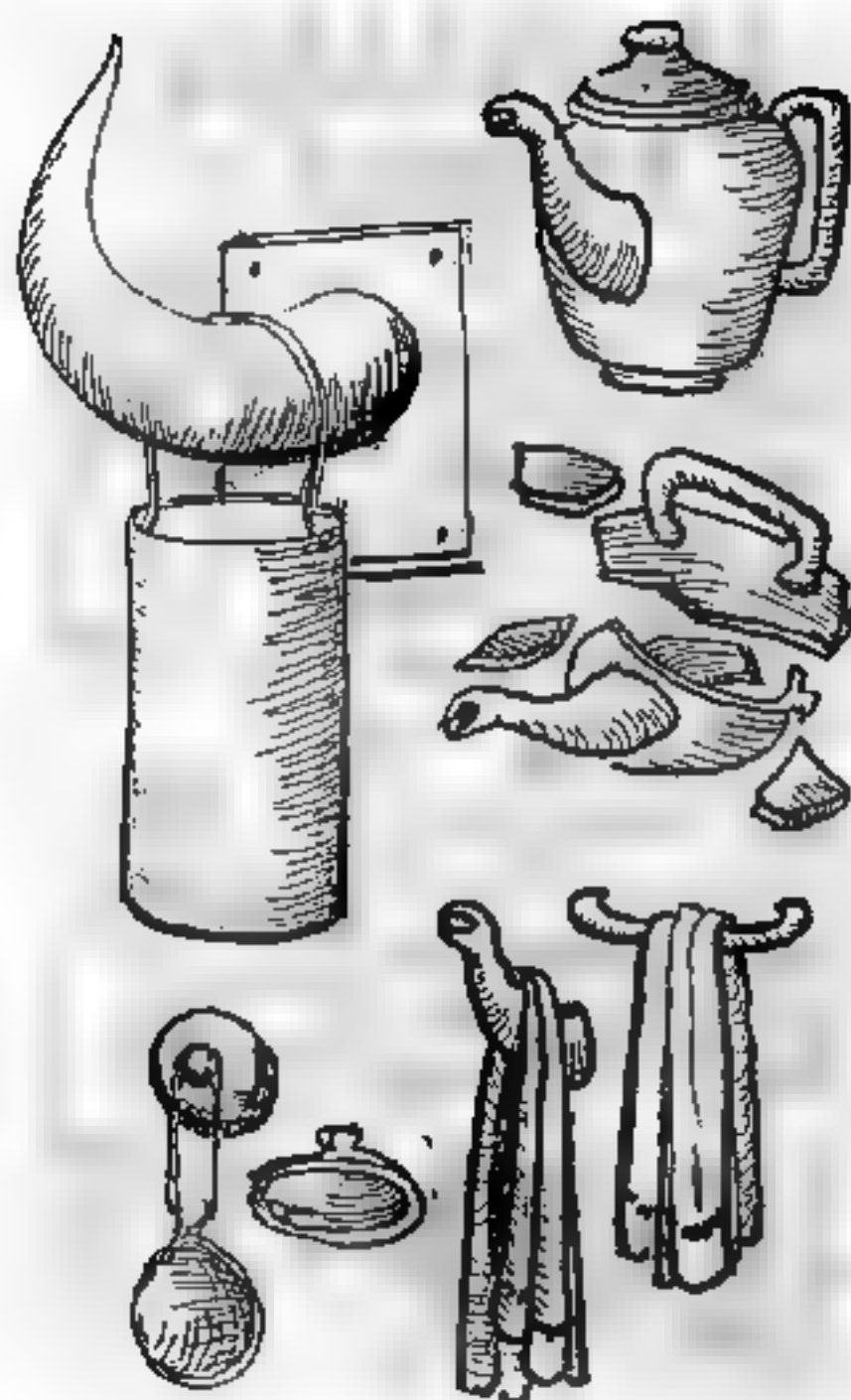
Now many  
prefer to  
cook



while standing --  
but often the  
hole for the pot is  
too high & the  
Cook has to stand  
on tip-toe to see  
what is cooking.



So be sure to  
plan for the TOP OF THE POT  
to be at Table  
level.



# SMOKELESS CHULAS

Formerly most  
people did their  
cooking on the  
floor.



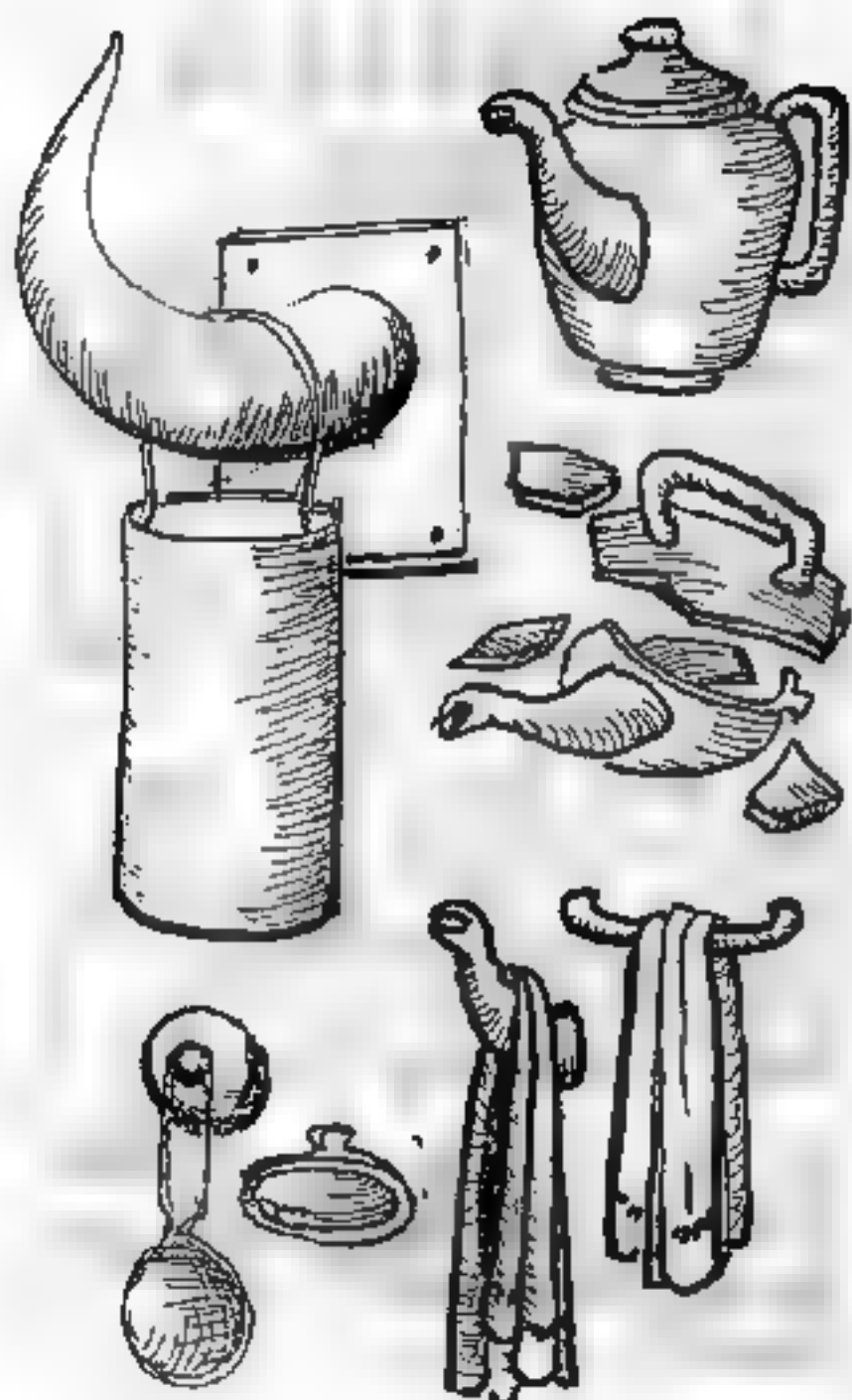
Now many  
prefer to  
Cook



while standing —  
but often the  
hole for the pot is  
too high & the  
Cook has to stand  
on tip-toe to see  
what is cooking.



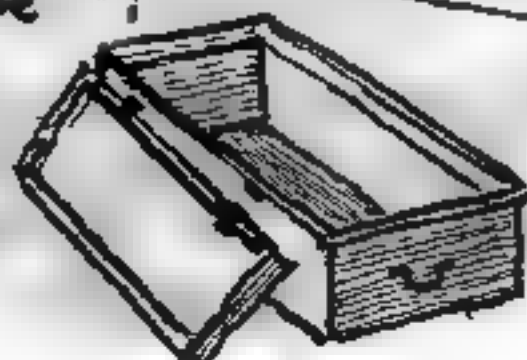
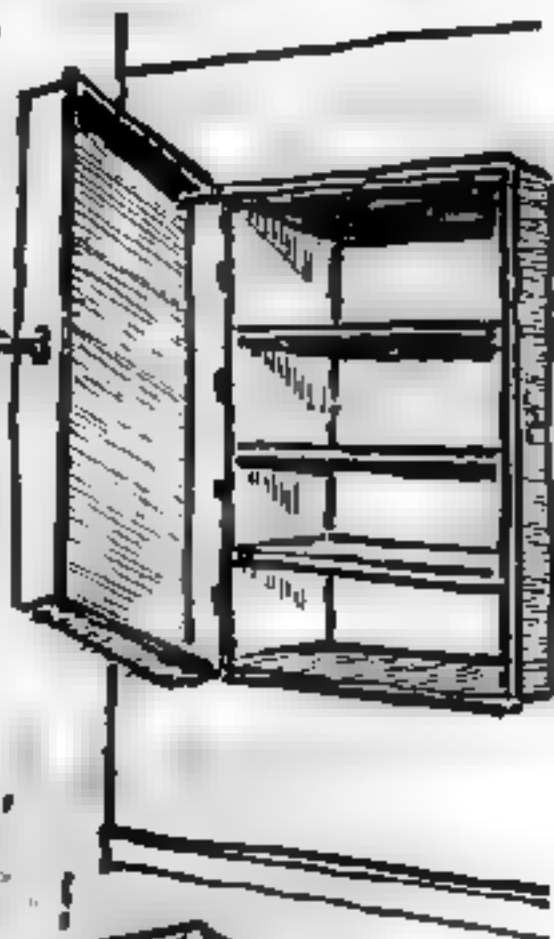
So be sure to  
plan for the TOP OF THE POT  
to be at Table  
level .



# MAKE USE OF OLD WASTE

Fix back  
the lid onto  
an old tin  
trunk &  
build it in  
to the wall  
& you have  
a rat and  
insect proof  
almirah.

Broken-off  
lids, spouts,  
horns, etc  
can all be  
used as  
hooks  
and  
hangers.



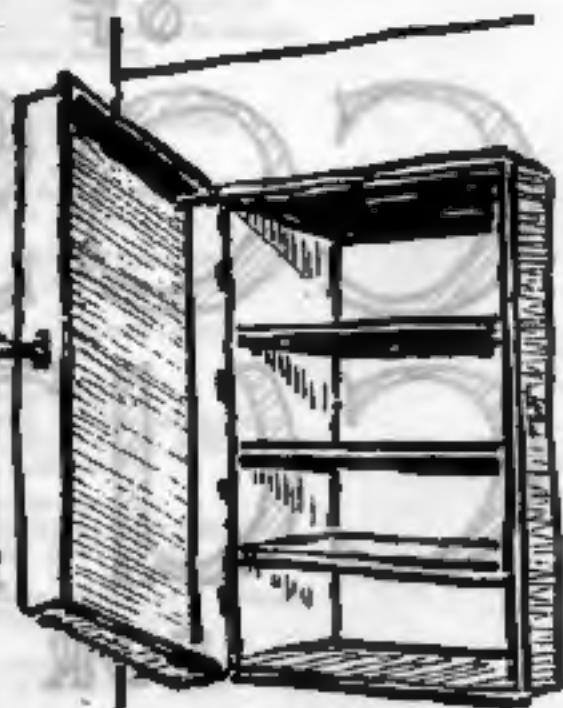
**MANUAL  
OF  
COST  
CUTS  
FOR  
SMALL  
HOUSES**

**RELATING TO ALL SCHEMES  
FOR HOUSING OUR  
MILLIONS OF HOMELESS  
FAMILIES**

# MAKE USE OF OLD WASTE

Fix back the lid onto an old tin trunk & build it in to the wall & you have a rat and insect proof almirah.

Broken-off lids, spouts, horns, etc can all be used as hooks and hangers.





**MANUAL**  
**OF**  
**COST**  
**CUTS**

**FOR**  
**SMALL**  
**HOUSES**

**RELATING TO ALL SCHEMES**  
**FOR HOUSING OUR**  
**MILLIONS OF HOMELESS**  
**FAMILIES**

## **COSTFORD**

**Centre of Science and Technology  
For Rural Development**  
(A Non-profit making voluntary organisation of  
Scientists, Technologists, Professionals, Educationists  
and Social Workers)

Supported by  
Department of Science and Technology  
Govt. of India

Department of Rural Development  
Govt. of India

Department of Local Self Government  
Govt. of Kerala

Housing and Urban Development Corporation  
HUDCO

### **MAIN OFFICE**

Ayyanthole • Thrissur - 680 003 • Kerala • India  
Phone : 0487 - 360786, 362623, 364203  
Fax : 0487 - 641575

### **SUB CENTRES :**

Deepthi • Near Ulloor Bridge • Pattam Palace P.O.  
Thiruvananthapuram - 4 • Phone : 0471 - 550810

Mandhady Road • Ramanikulangam • P.O. Kaveriad  
Kollam • Phone : 0474 - 798920

Bio-Technology Unit • Kannevungalass • Chetikulangam  
Mavelikkara • Phone : 0479 - 300518

Mulakhal P.O. • Alappadtha • Phone : 0477 - 253797

N/2-48 • Gr. Floor • Maiduthil • Potturipparam • AAAS

Breemsa Govt. Polytechnic • Velupad

Sargam • Pottumthi • Pothukad

Muvatt College • 1st Floor • Opposite Lakshmi Theatre  
Ponmani P.O. • Malappuram • Phone : 686299

Thekkolampara Road • Manalazhy P.O. • Kozhikode  
Phone : 0485 - 306906

Karai Nagar Colony • Thottiad P.O. • Kozhik - 7  
Co. D.P.E.P. • Near Civil Station

Kalpetta North P.O. • Wayanad

Kochilangadi • Malappuram 68470-4366  
Phone 0493 - 383659

4th, Sector 22 • HUDA  
Gurgaon • Haryana • Phone : 0124-367749